Natural Sciences Grade 7

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C O N N E X I O N S

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Chapter 1

Term 1

1.1 General Science[1]

1.1.1 NATURAL SCIENCES

1.1.2 Life and Way of Living

1.1.3

1.1.4 EDUCATOR SECTION

1.1.4.1 Memorandum

1. organisms
   environment
   non-living
   2. producers/manufacturers (food producers)
   consumers
   herbivores
   carnivores
   omnivores
   3. Location, climate, soil, water, atmospheric gases (more specific factors may also be listed, e.g. slope and south- /east-/ west-/ north-facing instead of location, or temperature, rain and wind instead of climate)
   Diagram:
   1. All materials are recycled in nature and that is why the resources are not depleted. Whatever is taken from the soil or the air is eventually returned to it.
   2. Water: from the soil to plants and animals (and into the air), back to the soil (urine and faeces) or air (perspiration, evaporation).
   Carbon dioxide: from the air to the plant, fixed in food, to the animal, released into the air.
   Components in the soil to the plant, forming nutrients, to animal that eats the plant, returning to the soil with urine or faeces, or when the plant or animal dies
   3. To prevent depletion of natural resources/ substances being used up

[1] This content is available online at <http://cnx.org/content/m19851/1.2/>.

1.1.5 Leaner Section

1.1.5.1 Content

1.1.5.2 ACTIVITY 1: To brush up your knowledge of eco-systems [LO 2.1, 2.3]

1.1.5.2.1 THE ECOSYSTEM

1.1.5.2.2 Test your knowledge

You were introduced to the concept of the ecosystem in Grade 6. Let us see how much you can remember:
Complete: An ecosystem is all the living _____ that live in a specific _____ as well as all the _____ factors that determine the nature of the environment.
In an ecosystem, the plants are the _____ while the animals are the _____ Animals can be divided into three groups on the basis of their manner of feeding, namely _____, _____ and _____
The non-living factors which determine conditions in the ecosystems are _____, _____, _____ and _____
.

1.1.5.2.3 Cycles and balance within an ecosystem

An ecosystem can be represented diagrammatically as follows:

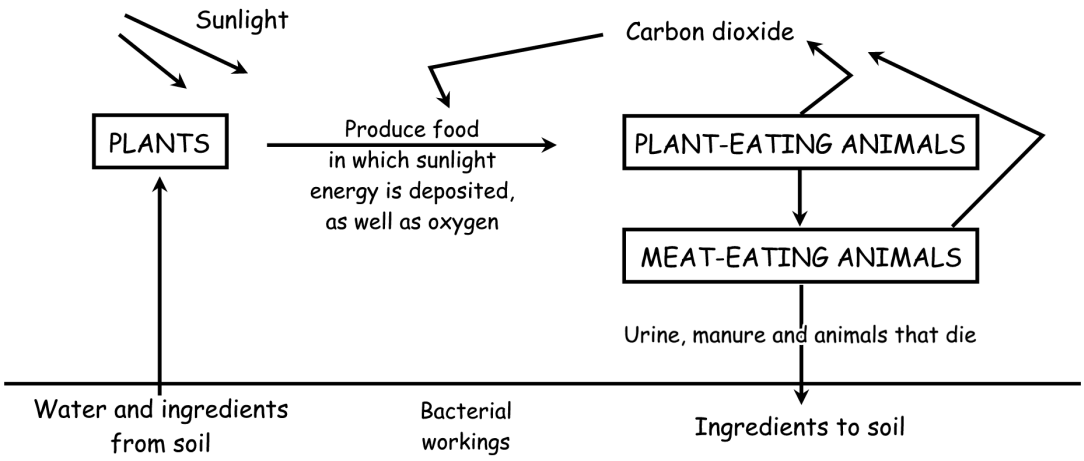


Figure 1.1

Try to answer the following questions that deal with the diagram:
1. Why is the ecosystem represented as a cycle?

_____
_____
_____
_____
_____

_____
_____

2. Name three substances/compounds that are circulated in an ecosystem according to the diagram, and give a brief description of each cycle:

_____
_____
_____
_____
_____
_____
_____

3. Why is it important for the substances to be circulated?

_____
_____
_____
_____
_____
_____
_____

1.1.5.2.4 Assessment

Learning Outcome 2: The learner will know and be able to interpret and apply scientific, technological and environmental knowledge.

Assessment Standard 2.1: We know this when the learner recalls meaningful information (at least definitions and complex facts);

Assessment Standard 2.3 We know this when the learner interprets information.

1.2 General Science[2]

1.2.1 NATURAL SCIENCES

1.2.2 Life and Way of Living

1.2.3

1.2.4 EDUCATOR SECTION

1.2.5 Memorandum

1. Number of plant types: four

- Four types: Trees: grow tall (long stem/trunk), branched, many leaves, standing singly.
- Shrubs: like trees but not as high (stems not long)

- Climbers/creepers: grow high but do not stand on their own – creeps or climbs up trees or any kind of structure.
- Ground covers, herbs: low-growing

2. In trees/shrubs: Insects, birds, snakes, squirrels

[2]This content is available online at <http://cnx.org/content/m19852/1.1/>.

- On the ground: Mice, insects, rabbits, birds, snakes, frogs
- In ground litter: Earthworms and other worms/caterpillars cicadas, frogs
- In soil: Earthworms, moles, snakes
- In water: Fish, insects, frogs

3. Each plant and animal is adapted for survival in its environment in a particular manner.

1.2.6 Leaner Section

1.2.6.1 Content

1.2.6.2 ACTIVITY 2: To interpret information gathered in a study of an ecosystem [LO 2.3]

1.2.6.3 VARIETY (DIVERSITY) WITHIN AN ECOSYSTEM

An ecosystem is characterised by a large *variety* of living organisms.

Look at the accompanying illustration of an ecosystem and answer the questions that follow. If you have access to a place where plants grow, especially if there also is water such as a stream or a dam, it could be worthwhile to spend a bit of time there and to try to find further information for your answers. You then have an *ecosystem* in which you can make your observations.

1. How many different types of plants can you distinguish? _____

- Try to distinguish four types and describe each of them:

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

2. Try to determine what types of animals you possibly might find in the following places in the ecosystem (consult books or investigate the ecosystem that you have chosen):

- In the trees and shrubs above the soil:

_____
_____
_____
_____

- On top of the soil:

_____
_____
_____
_____

- In the layer of dead plant material on top of the soil:

_____
_____
_____

- In the soil:

_____
_____
_____

- In the water:

_____
_____
_____

- Why is there such a variety of plants and animals?

_____
_____
_____
_____
_____

1.2.7 ASSESSMENT

Learning Outcome 2: The learner will know and be able to interpret and apply scientific, technological and environmental knowledge.

Assessment Standard 2.3: We know this when the learner interprets information.

1.3 General Science[3]

1.3.1 NATURAL SCIENCES

1.3.2 Life and Way of Living

1.3.3

1.3.4 EDUCATOR SECTION

1.3.5 Memorandum

1. Equally thick: yes no
   Equally long: yes no
   Main root: no yes
   Branching no yes

2. **Taproots:** Trees and shrubs, some herbs, climbers. Remaining alive for longer that a year, growing tall (needing an anchor) and/or has to obtain water from deep in the ground.

Adventitious roots: groundcovers and annual plants/plants that remain alive for one year only. Takes up every drop of water, even dew. Does not need to be anchored well to remain upright.

Diagram: Adventitious roots, taproots, monocotyledons, dicotyledons

[3]This content is available online at <http://cnx.org/content/m19853/1.1/>.

1.3.6 Leaner Section

1.3.6.1 Content

1.3.6.2 ACTIVITY 3: To study root systems of plants

1.3.6.3 [LO 1.2; LO 2.1, 2.2, 2.3]

1.3.6.4 PLANT DIVERSITY

In Grade 6, you learned that plants could have leaves with different shapes because they are adapted to specific environmental conditions, and that the plants can be divided into groups on the basis of their leaves.

Let us now take a look at the **roots** of plants.

Study the representations of the two types of roots below (you will make the teacher very happy if you can bring real examples of plants with the two types of roots to class).

Figure 1.2

1.3.6.5 An adventitious root system

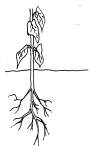


Figure 1.3

1.3.6.6 A tap-root system

1. Try to complete the table by writing yes or no in each block:

	Tap-root system	Adventitious root system

continued on next page

All the roots are equally thick		
All the roots are equally long		
There is a main root that is longer and thicker than the others		
The roots branch (smaller roots grow from the larger roots)		

Table 1.1

2. Which of the plants in the sketch of an ecosystem (page 3) do you think will have adventitious roots and which do you think will have taproots? Also say why you think so:

____
____
____
____
____
____
____
____
____
____
____
____
____

Do you still remember the division of plants that you did in Grade 6 that is shown below? Use what you have just learned about root systems to add to the division by writing the missing information in the open blocks (ask your teacher to help you):

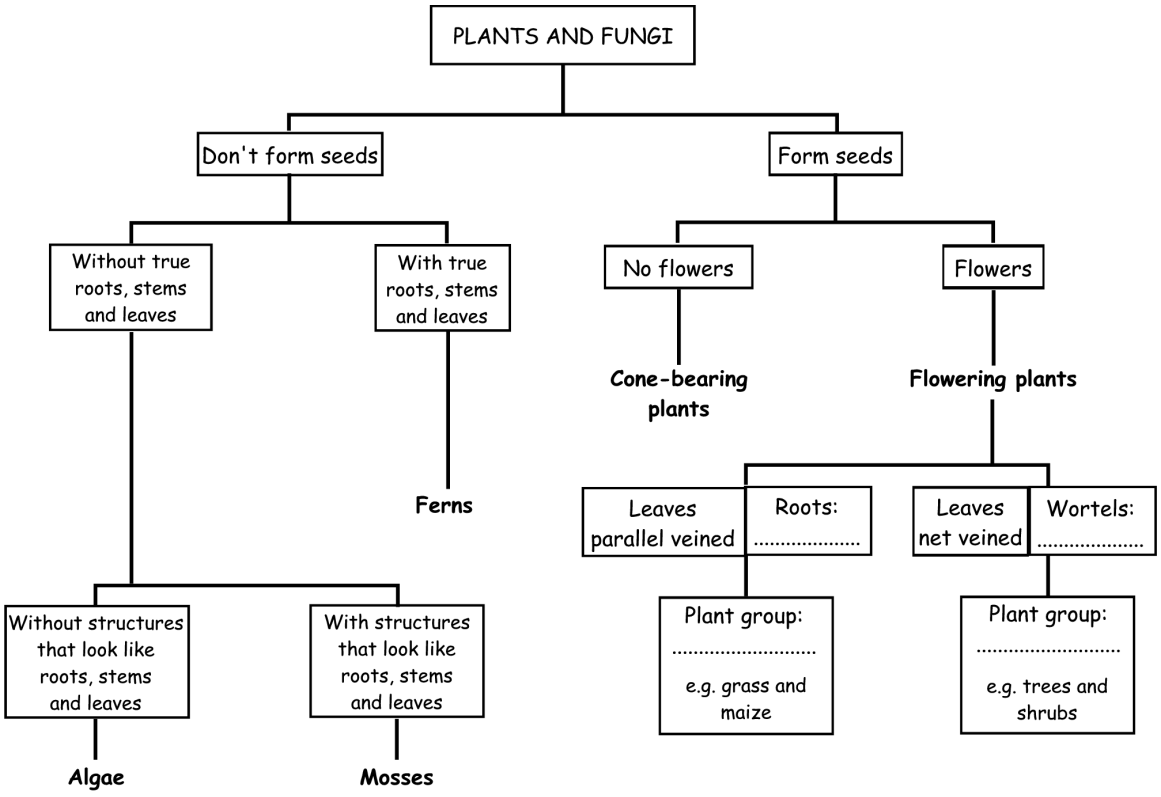


Figure 1.4

1.3.7 ASSESSMENT

Learning Outcome 1: The learner will know and be able to interpret and apply scientific, technological and environmental knowledge.

Assessment Standard 1.2: We know this when the learner interprets information.

Learning Outcome 2: The learner will know and be able to interpret and apply scientific, technological and environmental knowledge.

Assessment Standard 2.1: We know this when the learner recalls meaningful information (at least definitions and complex facts);

Assessment Standard 2.2: We know this when the learner categorises information (can compare the properties of categories of organisms);

Assessment Standard 2.3: We know this when the learner interprets information;

1.4 General Science[4]

1.4.1 NATURAL SCIENCES

1.4.2 Life and Way of Living

1.4.3

1.4.4 EDUCATOR SECTION

1.4.5 Memorandum

Assignment 1:

An instrument that is used to identify a plant or an animal (to determine the name). It provides options according to which the characteristics of the plant or animal can be selected to serve as a guide to the answer (the name of the relevant plant or animal).

1.4.5.1 ACTIVITY 4: To categorise plants by comparing their characteristics [LO 2.2]

1.4.5.2 THE DEVELOPMENT OF A KEY WITH WHICH TO CLASSIFY PLANTS

You have now been introduced to various characteristics of plants and have learned that we can group the plants in terms of their characteristics. A lot of work has already been done in this regard by biologists and all the plants that are known to people have already been divided into groups. New plants that are discovered can also be placed into a group immediately.

The advantage of this is that we can identify any plant that we see, find out its name and discuss it with other people. For example, we can determine whether a plant is indigenous or exotic, whether it is a harmful weed, what we can do with it, etc.

To be able to identify a plant we can make use of a *key*. We will now use our knowledge about plant characteristics and plant groups to compile our own key.

The easiest way is to pretend that you have seen a particularly interesting plant and want to go to a plant expert (botanist) to ask him/her to which group the plant belongs. Try to think what type of questions you would ask such a person in order to find out the answer.

The person most probably will ask questions to which you can answer yes or no. In this manner, it is possible to use each question to eliminate one possibility and thereby to move in the direction of the answer.

Let us try. Use the diagrammatic division of plants on the previous page and work through it from top to bottom on the basis of the questions that follow:

1. Does the plant form seeds?

- Yes _____

(Proceed to 2)

- No _____ Algae or mosses

(Proceed to 4)

2. Does the plant bear flowers?

- Yes _____ (Proceed to 3)
- No _____ Coniferous plants, e.g. fir tree (Proceed to 12)

3. Does the plant have vein-like leaves or does it have an adventitious root?

- Yes _____ Dicotyledonous plants e.g. proteas (Proceed to 20)
- No _____ Monocotyledonous plants, e.g. grasses (Proceed to 40)

[4]This content is available online at <http://cnx.org/content/m19854/1.1/>.

1.4.5.3 Assignment 1:

Describe in your own words what a key for the identification of plants or animals is and how it is used.

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

1.4.6 ASSESSMENT

Learning Outcome 2: The learner will know and be able to interpret and apply scientific, technological and environmental knowledge.

Assessment Standard 2.2: We know this when the learner categorises information (can compare the properties of categories of organisms).

1.5 General Science[5]

1.5.1 NATURAL SCIENCES

1.5.2 Life and Way of Living

1.5.3

1.5.4 EDUCATOR SECTION

1.5.4.1 Memorandum

Vertebrates and invertebrates

Fish, amphibians, reptiles, birds, mammals

Common chacteristic (p. 10): invertebrate

Table:

1. Starfish, sea anemone
2. Mussel, snail, octopus
3. Earthworm
4. Locust, cricket, cicada
5. Tick, spider, scorpion
6. Crayfish, prawn/shrimp, crab
7. Centipede, millipede

Group 1: 1, 2 and 3

Group 2: 4, 5, 6 and 7

Reason: presence or absence of exoskeleton (external skeleton) or articulated legs

[5]This content is available online at <http://cnx.org/content/m19855/1.1/>.

Assignment 2:

Key: There are always two options, selection of an option must lead to insects. The following features must be included: invertebrate, arthropod, exoskeleton, six legs.

1.5.5 Leaner Section

1.5.5.1 Content

1.5.5.2 ACTIVITY 5: To categorise plants by comparing their characteristics [LO 2.2]

1.5.5.3 ANIMAL DIVERSITY

Can you still remember what you learned about the division of animals in Grade 6? You learned that animals can be divided into two main groups, namely the

_____ and _____

You also learned that vertebrates could be divided into five groups:

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

1.5.5.4 Let us now take a look at the invertebrates.

We will study a number of examples of invertebrates. You will realise that they all share specific characteristics, but that, on the other hand, they also differ greatly from one another. We will use two methods to try to make it easy to understand and remember the similarities and the differences: firstly, we will determine how the animals are adapted for survival (this causes differences between different animals), and then we will classify the animals on the basis of the similarities and differences. If you classify things, it means that you group those with the same properties or characteristics together.

Biologists have already identified more than 2 million different types of living organisms and new types are still being discovered. There is a strict international code according to which living organisms are named, sorted and classified. It is based on the work of *Linnaeus*, who suggested that every organism should be given two names. Today, all living organisms have two scientific Greek or Latin names:

- The genus name (genus/genera), which is always written with a capital letter, e.g. *Panthera* for the large cats.
- The species name, which is written with a small letter, e.g. *leo* for the lion.

The complete name of the lion therefore is *Panthera leo*, while that of the leopard is *Panthera pardus*. The same is applicable to the invertebrates.

We will first do an overview of the invertebrates so that you can get to know the group with its smaller groupings. For this purpose, we will look at the similarities and differences between the animals.

Then we will study a few examples in greater detail so that you can discover how the animals are adapted to the conditions in their ecosystems.

CLASSIFICATION OF THE INVERTEBRATES

A number of different invertebrates are represented below.

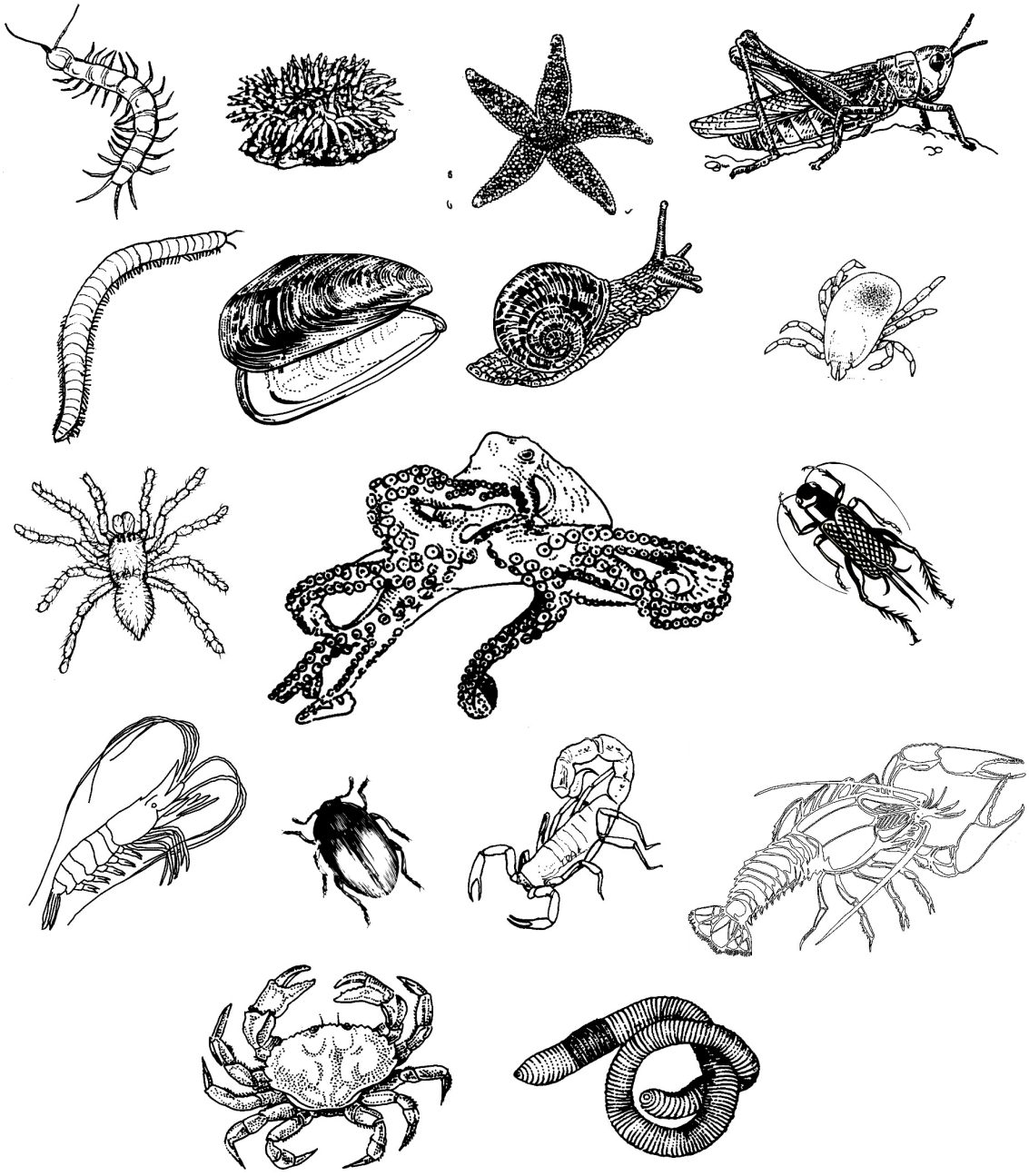


Figure 1.5

Can you still remember what characteristic(s) is/are applicable to all these

animals? _____
_____
_____
_____
_____

Now try to divide them into approximately eight groups on the basis of their characteristics.
In the following table, one or two characteristics of each group are provided to make it easier for you.

GROUP	CHARACTERISTIC	ANIMALS
1	No head, only one opening in the body, with 'arms' around the mouth	
2	Soft body, large muscular foot, sometimes arms, often with a shell	
3	Large round body that consists of ring-shaped segments	
4	Hard or tough body with six articulated legs	
5	Hard or tough body with eight articulated legs	
6	Hard or tough body with ten articulated legs	

Table 1.2

Now try to group the six groups in the table together to form two main groups:
Group 1 consists of groups _____
Group 2 consists of groups _____
Explain why you grouped them as you did:

_____
_____
_____
_____
_____
_____

Compare your division with the following diagram:

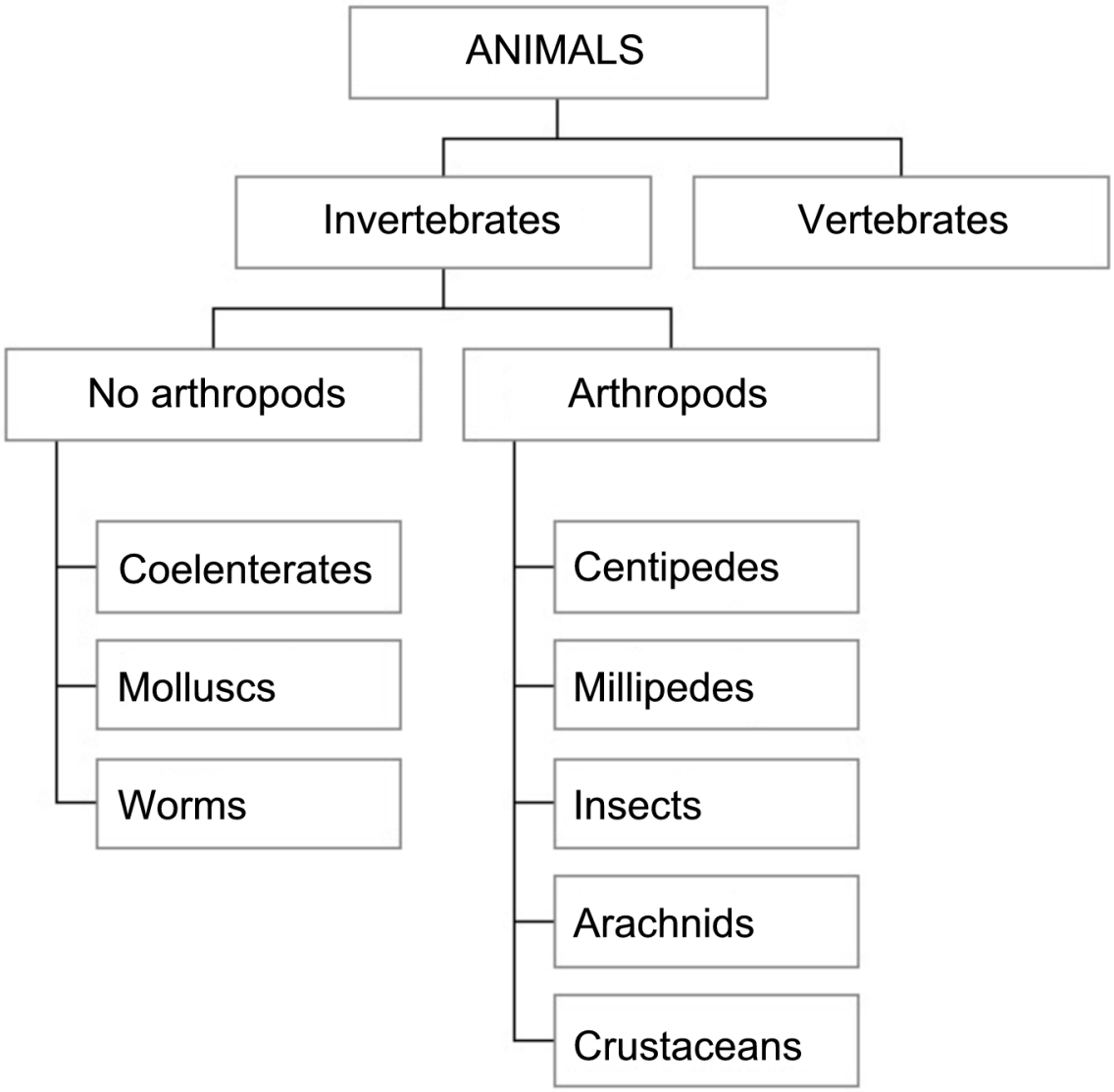


Figure 1.6

1.5.5.5 Assignment 2:

Compile a key that will lead someone who has caught a strange insect to the answer that it is an insect.

1.5.6 ASSESSMENT

Learning Outcome 2: The learner will know and be able to interpret and apply scientific, technological and environmental knowledge.

Assessment Standard 2.2: We know this when the learner categorises information (can compare the properties of categories of organisms).

1.6 General Science[6]

1.6.1 NATURAL SCIENCES

1.6.2 Life and Way of Living

1.6.3

1.6.4 EDUCATOR SECTION

1.6.5 Memorandum

Growth, reproduction, locomotion, respiration, feeding and excretion/defecation / water balance.

1.6.6 Leaner Section

1.6.6.1 Content

1.6.6.2 ACTIVITY 6: To distinguish living organisms from non-living things [LO2.1]

1.6.6.3 A STUDY OF A FEW INVERTEBRATES

We will now look at a few examples of the invertebrates in greater detail.

Remember that we will look particularly at the manner in which they are adapted to be able to survive in their environment (the ecosystem).

Can you remember what characteristics of living organisms distinguish them from non-living things?

Write them down below:

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

You will agree that if we want to study an animal in its habitat (in the ecosystem), we will have to look at these characteristics in particular.

[6] This content is available online at <http://cnx.org/content/m19856/1.1/>.

1.6.7 ASSESSMENT

Learning Outcome 2: The learner will know and be able to interpret and apply scientific, technological and environmental knowledge.

Assessment Standard 2.1: We know this when the learner recalls meaningful information (at least definitions and complex facts).

1.7 General Science[7]

1.7.1 NATURAL SCIENCES

1.7.2 Life and Way of Living

1.7.3

1.7.4 EDUCATOR SECTION

1.7.5 Memorandum

Earthworm:

1. It takes dead matter into the soil, loosens the soil (aerates the soil / makes it possible for gases and water to enter the soil), serves as food for other animals.

2. The outer covering is moist and soft for respiration. The body therefore dries out very easily and respiration cannot take place through the dried-out skin.

3. It can kill animals like earthworms. This will result in the soil becoming hard and dry and water, gases and dry material will not enter the soil: the soil will become infertile.

1.7.6 Leaner Section

1.7.6.1 Content

1.7.6.2 ACTIVITY 7: To interpret information about the earthworm [LO 2.1, LO 2.3]

1.7.6.3 THE EARTHWORM

The earthworm is part of a group that is known as *segmented worms*.

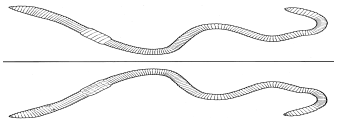


Figure 1.7

It is important that you get to know the earthworm, as this small animal plays a very important role in the ecosystem.

Let us look at how its body is adapted to its way of life.

[7]This content is available online at <http://cnx.org/content/m19857/1.1/>.

1.7.6.3.1 Build

The earthworm is approximately 150 mm long and the whole body consists of ring-shaped segments, each approximately 1 mm thick.

At the front tip there is a mouth with a small lip with which food is pushed into the mouth. At the back tip is the *anus*, where the remains of the food leave the body.

On all the segments, except the first and the last, there are hairs that help the worm to move through the soil.

1.7.6.3.2 Movement

The earthworm moves by means of muscles in the segments that contract and relax, causing the body to become long and thin, and then short and thick. The hairs on the segments press against the soil and the worm then moves forward.

1.7.6.3.3 Feeding

The earthworm comes out of the ground at night and pulls rotting plant material into its tunnel with the help of the lip in front of its mouth. It also eats the soil as it tunnels through the ground.

Respiration

The earthworm breathes through its moist skin. It therefore is important that the skin remains moist, as the worm is dependent on a moist environment.

1.7.6.3.4 Maintaining a water balance

The earthworm has a complex system of tubes in its body with openings to the outside by which it controls the quantity of water that its body absorbs and excretes so that the correct balance is maintained.

1.7.6.3.5 Reproduction

Two earthworms lie next to one another and exchange sexual cells. A slime cocoon forms around their bodies and the sexual cells remain in the cocoon when it slips off the bodies. The young hatch in the cocoon and immediately look just like their parents.

In summary: the earthworm in the ecosystem

1. The earthworm plays an important role in the ecosystem because it ... (give two reasons)

_____
_____
_____
_____
_____

2. The earthworm is dependent on a moist environment because _____

_____
_____
_____
_____
_____

3. If we use poison to combat pests, it can be disadvantageous to the soil because

_____
_____
_____
_____
_____

1.7.7 ASSESSMENT

Learning Outcome 2: The learner will know and be able to interpret and apply scientific, technological and environmental knowledge.

Assessment Standard 2.1: We know this when the learner recalls meaningful information (at least definitions and complex facts);

Assessment Standard 2.3: We know this when the learner interprets information.

1.8 General Science[8]

1.8.1 NATURAL SCIENCES

1.8.2 Life and Way of Living

1.8.3

1.8.4 EDUCATOR SECTION

1.8.4.1 Memorandum

- Locust:
- No, yes, 6

1. Large: 2
Small: 3
2. Three
3. Four
4. No. Forewings hard and leathery, rear wings soft/delicate and can be opened out to form a large surface area
5. Like plastic, hard
6. Feelers
7. No. There are spiracles on each segment of the abdomen.
8. Yes. Mouth parts are located at the bottom of the head. Cutting edges and feelers.
9. 6 legs.
10. No. The rear legs are stronger.
11. No. The females and males differ. The female locust has an ovipositor and the male has a copulatory organ.
12. Protection: hard external skeleton, but it can use the feelers for feeling. Does not lose moisture, can cope without water. Can move around easily: walks, sometimes flies of jumps. Can look for food because of its locomotive ability, can see, has good mouth parts.
13. The learner should draw from life. If possible, a real creature must be observed.
14. Life cycle: adult, eggs, larva, pupa
Assignment 3:

- Dependence on water: able to survive dry conditions, able to live in environments where there is no vigorous competition from other animals. Exoskeleton prevents loss of moisture, eats plants that contain sufficient water.

- Obtaining food: locusts are able to move fast and far to look for food. Eggs can survive dry conditions and hatch when the soil is becomes moist (rain) and plants are green.

[8]This content is available online at <http://cnx.org/content/m19859/1.1/>.

- Insects that display complete metamorphosis: survive in the form of a pupa, eggs hatch when food is available.

- Respiration: tubes in the body transport the gases. They remain moist (do not dry out as easily as the earthworm).

- Senses and communication: smells and feels with help of antennae; has a tympanic membrane (eardrum) on the first segment of the abdomen, creates sound by rubbing the rear legs against the rough wings (locust; other insects differ, but the main thing is that they are able to communicate).

1.8.5 Leaner Section

1.8.5.1 Content

1.8.5.2 ACTIVITY 8: To investigate and describe the grasshopper's ability to survive [LO 1.1, LO 1.2, LO 2.3, LO 2.4]

1.8.5.3 THE GRASSHOPPER

The grasshopper belongs to the largest group in the animal kingdom, namely the insects.
What do you already know about this group?

- Spinal column: yes or no?_____
- Legs: articulated or not?_____
- Number of legs:_____

Investigation: Catch a few different types of insects and bring them to class. Form groups of two or three and study the insect in the group of which the body parts can be distinguished easily. A grasshopper or a cricket works well. Answer the following questions (try your best to give a good answer so that you can get a good mark):

1. An insect has large as well as small eyes.

- Large: _____
- Small: _____

2. In how many main parts would you divide the body? _____
3. How many wings does the insect have? If the wings are folded against the body, lift them up and look carefully. _____
4. Are all the wings the same? _____
Describe. _____
_____
_____
5. What does the insect's skin covering feel like?
_____
_____
6. What does the insect feel with?
_____
_____
_____
_____
7. Does the insect have a nose with which to breathe? Describe
_____

_____
_____
_____

8. Does the insect have a mouth? Describe.

_____
_____
_____
_____

9. How do you know that it is an insect that you are busy studying?

_____
_____
_____
_____

10. Are all the legs developed equally strongly? _____
What do you observe? _____
_____
_____

11. Do the tips of the abdomen look the same in all the insects of the same type? ___
Describe. _____
_____
_____
_____
_____

12. Insects are particularly well adapted to be able to survive under different circumstances. Describe (refer to protection, need of water, movement, ability to look for food).

_____
_____
_____
_____
_____
_____
_____
_____

13. Make a drawing of the insect as seen from the side.

1.8.5.3.1 Build

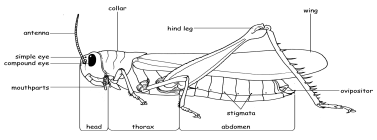


Figure 1.8

- The body consists of three main parts: the head, the thorax and the abdomen.

- The insect has an exoskeleton that consists of a strong leathery material called *chitin*.
- The three pairs of articulated legs are attached to the thorax.
- Two pairs of wings are also attached to the thorax: the front ones are leathery and lie flat against the body; the hind ones are soft and fold underneath the front ones like fans.
- The head bears:

- two antennae (feelers) with which the insect feels;
- three small eyes that are called simple eyes;
- two large or compound eyes; and
- mouth parts.

- The abdomen has no attachments, except for small sexual organs at the tip that differ in the case of the male and the female.
- There is a small spiracle (breathing opening) on each segment of the abdomen.

1.8.5.3.2 Movement

Insects are very mobile. Just think about the agility of a fly and the distance that swarms of grasshoppers can fly.

The legs are articulated. The hind legs of the grasshopper are developed more strongly so that it can jump.

The front wings fold open diagonally and balance the insect during flight (like the wings of an aeroplane), while the soft hind wings fold open like fans and do the actual flying.

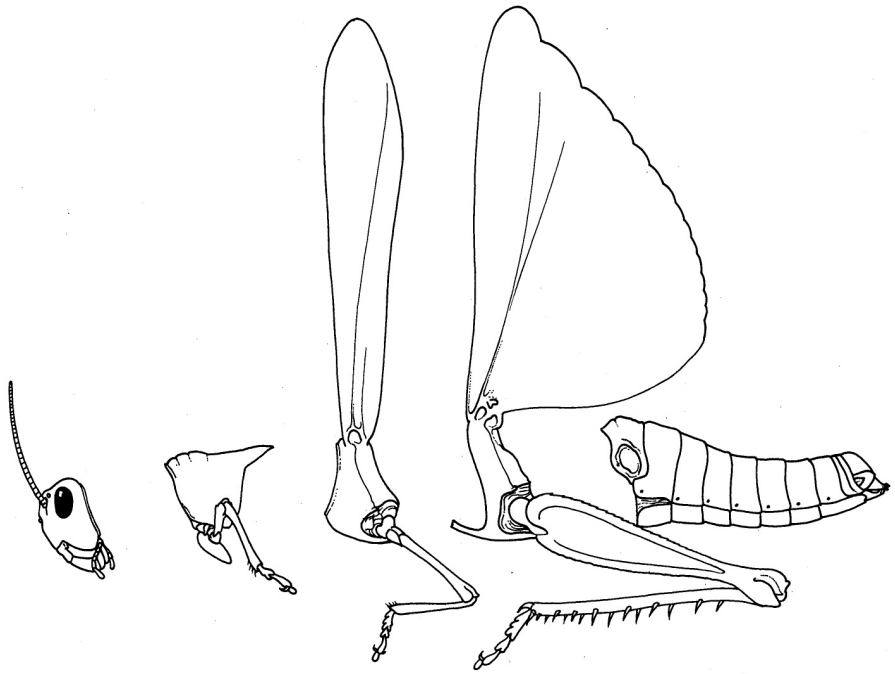


Figure 1.9

1.8.5.3.3 Feeding

The grasshopper is a herbivore with mouthparts that are very well adapted for this purpose. Amongst others, there are two small feelers with which it can feel the food so that it can push the food into its mouth. There are also two jaws with cutting edges that finely cut up the plant material. The grasshopper therefore has biting mouthparts.

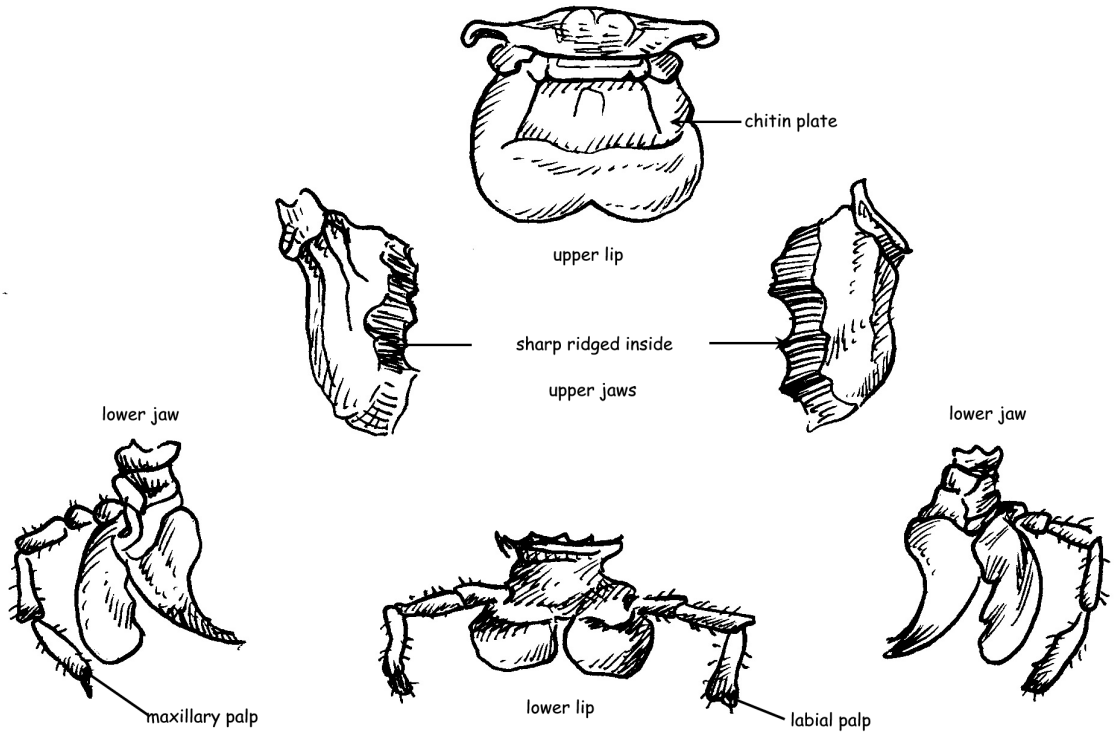


Figure 1.10

Other insects have the same mouthparts as the grasshopper, although the shape can differ greatly to adapt to other ways of eating. For example, they can be licking (the fly), sucking (some moths) or biting (the mosquito).

1.8.5.3.4 Respiration

On either side of each of the first eight abdominal segments is a spiracle. These openings lead to a network of tubes (trachea) that branch throughout the whole body and transport air.

1.8.5.3.5 Maintaining a water balance

The exoskeleton of the grasshopper forms a watertight skin covering. This means that the body does not lose moisture and therefore can survive in dry conditions. The plant material eaten by the grasshopper contains sufficient water.

Reproduction

In Grade 6 you learned that a fruit fly undergoes a complete change of form, or metamorphosis, from the time the egg hatches until an adult fly has developed. Can you still remember the stages? Fill them in on the illustration below.

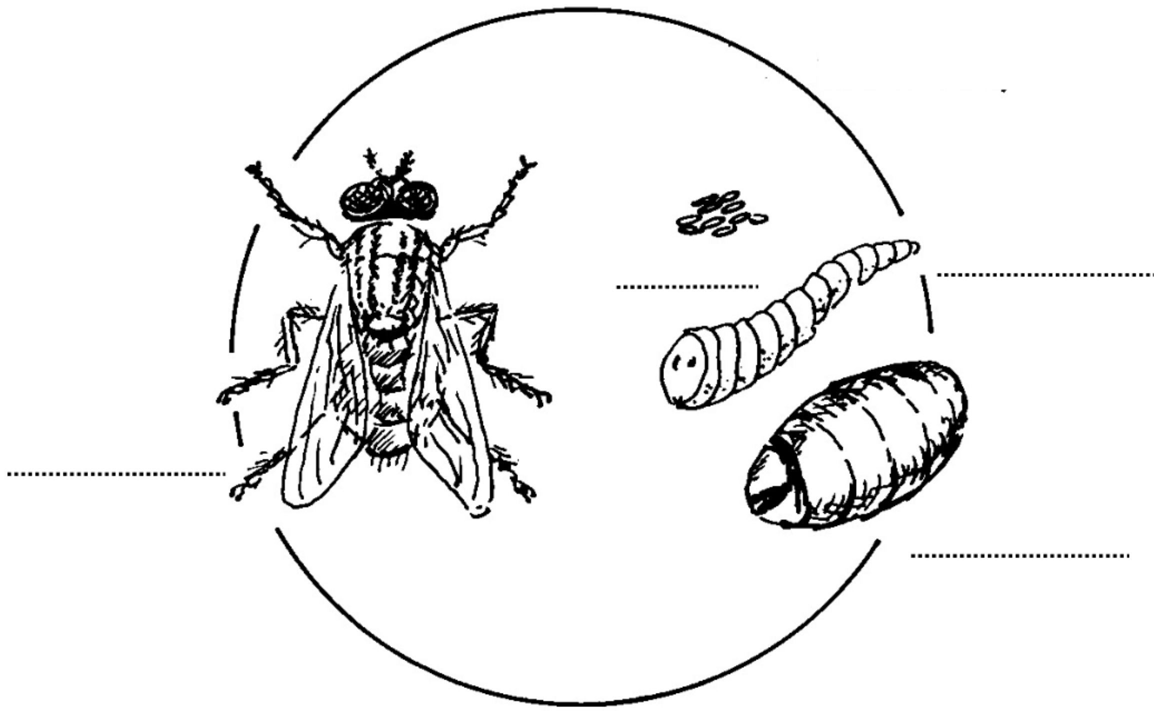


Figure 1.11

The grasshopper does not undergo a complete metamorphosis. After the male and female have mated, the female lays eggs in the ground with her ovipositor. The small grasshoppers that hatch look just like the adults. They moult a few times as they grow. We therefore speak of incomplete metamorphosis.

1.8.5.4 The grasshopper and other insects in the ecosystem

1.8.5.5 Assignment 3:

Explain why the grasshopper and other insects are adapted to their environment particularly well.

Dependence on water:

____
____
____
____
____
____

Obtaining food (distinguish between the grasshopper and other insects that undergo a complete metamorphosis).

Grasshopper:

Insects that undergo complete metamorphosis:

Respiration (Tip: why are insects not as dependent on a moist environment as the earthworm is?):

Senses and communication (Tip: research whether grasshoppers can hear and make sounds)

1.8.6 ASSESSMENT

Learning Outcome 1: The learner will be able to act confidently on curiosity about natural phenomena, and to investigate relationships and solve problems in scientific, technological and environmental contexts.

Assessment Standard 1.1: We know this when the learner plans investigations;

Assessment Standard 1.2: We know this when the learner conducts investigations and collects data.

Learning Outcome 2: The learner will know and be able to interpret and apply scientific, technological and environmental knowledge.

Assessment Standard 2.3: We know this when the learner interprets information;

Assessment Standard 2.4: We know this when the learner applies knowledge in a variation of a known situation.

1.9 General Science[9]

1.9.1 NATURAL SCIENCES

1.9.2 Life and Way of Living

1.9.3

1.9.4 EDUCATOR SECTION

1.9.4.1 Memorandum

- All have eight legs. Articulated legs and external skeleton are common characteristics.
- Cephalothorax and abdomen.
- The pedipalps may be large and look like feet.
- On the cephalothorax.
- Simple eyes only, some may be smaller than others: eight in all.

Assignment 4:

1. Spiders are killed by the poison and the numbers of flies increase, possibly because there are fewer spiders.
2. It may be a type of bird that lives on insects and spiders. It might eat poisoned caterpillars, or there might not be enough spiders to eat.
3. It is important to maintain the natural balance.

1.9.5 Leaner Section

1.9.5.1 Content

1.9.5.2 ACTIVITY 9: To study a few arachnids [LO 1.3, LO 2.3, 2.4]

1.9.5.3 THE SPIDER

The spider belongs to the group of *arachnids* or *Arachnida*. Some arachnids can spin webs, such as the spider, while others, such as ticks and scorpions, do not spin webs.

Can you still remember the characteristics of all arachnids?

They all have _____ legs.

Can you still remember what characteristic the arachnids share with the insects?

_____

If your teacher has a dead spider or scorpion, look at its build and try to answer the following questions:

Can you distinguish a head, thorax and abdomen as in the case of the grasshopper? _____

Why does it look as if there are ten legs? _____

_____

To which part of the body are the legs attached? _____

Can you see small and large eyes as in the case of the grasshopper? _____

[9] This content is available online at <http://cnx.org/content/m19861/1.1/>.

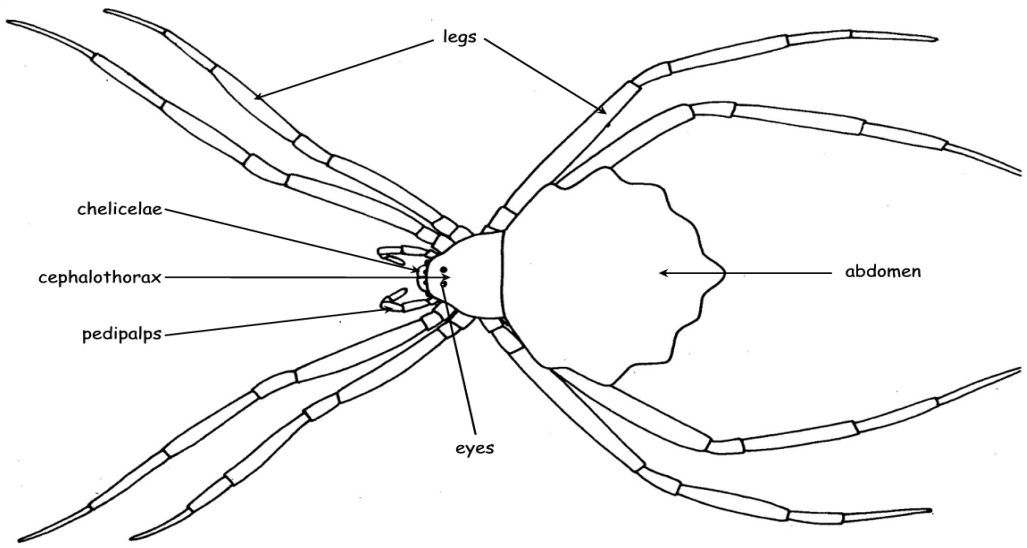


Figure 1.12

1.9.5.3.1 Build

The body of the spider consists of only two parts, namely a cephalothorax and an abdomen. There are eight simple eyes on the cephalothorax (the spider does not have compound eyes like other insects), as well as two palps or feelers. The spider has two conspicuously large pedipalps with which it catches its prey.

There are spinnerets at the tip of the abdomen with which the spider builds cobwebs in which to catch prey.

The skin covering (exoskeleton) is leathery and hairy.

1.9.5.3.2 Movement

Spiders are particularly agile, particularly those that do not catch their prey in a web, e.g. the large hunting-spider.

1.9.5.3.3 Feeding

Spiders are meat eaters (carnivorous) and paralyse their prey with poison that is stored in their pedipalps. The palps handle the prey while it is being eaten. In South Africa, there are only a few spiders that are harmful to people, e.g. the button-spider (black with distinct markings on the underside; the body excluding the legs is approximately the size of a peanut). However, spider bites can become infected as a result of the germs that are found around their mouthparts.

1.9.5.3.4 Respiration

The spider has spiracles on the underside of the abdomen that lead to internal *book-lungs*.

1.9.5.3.5 Maintaining a water balance

As in the case of the grasshopper, spiders obtain the little water that they need from their food.

1.9.5.3.6 Reproduction

Small spiders look like the adults.

1.9.6 The spider and other arachnids in the ecosystem

Insects are adapted very well to their environment, as is the case with the spiders, scorpions and ticks; they can survive extremely dry conditions. They feed on other animals that are also hunters (not the tick, though, which is a parasite) and therefore play an important role in maintaining a balance in the ecosystem. Spiders therefore should preferably not be killed. The same is valid for scorpions, but care should be taken in the case of those with thick tails – they are poisonous to humans.

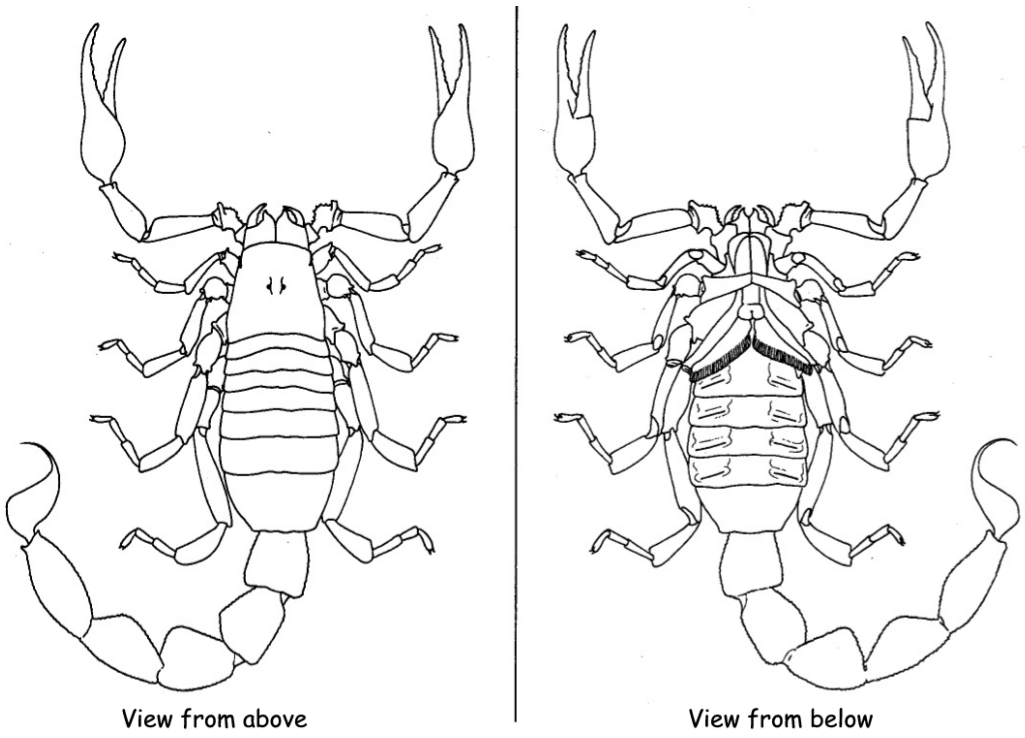


Figure 1.13

1.9.6.1 Assignment 4:

Study the following and answer the questions that follow:

The owner of a garden sprays poison on the plants in his garden to get rid of caterpillars. The gardener is unhappy about this and decides to have a look at how the poison affects other animals in the garden.

Every day he counts how many spiders and flies, amongst others, he can find in the garden. He does not want to identify Animal X in the table. He notes down the numbers of creatures.

Number of animals that can be found in the garden within one hour on the indicated dates.

	2 January	9 January	16 January	23 January
Spiders	20	10	7	2
Flies	2	12	24	38
Animal X	5	4	2	0

Table 1.3

1. Explain what happened in the garden from 2 January until 23 January by referring to the numbers.

2. What animal could Animal X possibly be? Explain why you think so.

3. What should the owner learn from this situation?

1.9.7 ASSESSMENT

Learning Outcome 1: The learner will be able to act confidently on curiosity about natural phenomena, and to investigate relationships and solve problems in scientific, technological and environmental contexts.

Assessment Standard 1.3: We know this when the learner evaluates data and communicates findings.

Learning Outcome 2: The learner will know and be able to interpret and apply scientific, technological and environmental knowledge.

Assessment Standard 2.3: We know this when the learner interprets information;

Assessment Standard 2.4: We know this when the learner applies knowledge in a variation of a known situation.

1.10 General Science[10]

1.10.1 NATURAL SCIENCES

1.10.2 Life and Way of Living

1.10.3

1.10.4 EDUCATOR SECTION

1.10.4.1 Memorandum

- The crab
- They have 10 legs.
- The body consists of a cephalothorax and abdomen.
- Skin covering is hard, like plastic.
- The first pair of legs bears pincers.
- The eyes are borne on stalks (two stalks with one eye each).
- The mouth parts cut, are flat and are moved to propel water into the gill chambers.

Research assignment:

Provide the following guidelines:

Respiration involves effective gas exchange: oxygen and carbon dioxide.

The surface for gas exchange must

- Remain moist
- Be as large as possible

Now compare the adaptation of the four named animals in this regard, as well as the ways in which their adaptation helps (or doesn't help) them to survive under different conditions.

Test your knowledge:

- 10
- gills, gill chambers, water
- exoskeleton, calcium
- cephalothorax and abdomen.

1.10.5 Leaner Section

1.10.5.1 Content

1.10.5.2 ACTIVITY 10: To study the crab and compare various invertebrates [LO 1.1, LO 1.2, LO 1.3, LO 2.3]

1.10.5.3 THE CRAB

Crabs belong to the group of *crustaceans* (shell-fish) or *Crustacea*, which also includes lobsters, shrimps, prawns and mussels. Most members of the group are marine animals.

[10]This content is available online at <http://cnx.org/content/m19862/1.1/>.

Can you still remember how the crustaceans differ from the insects and the arachnids?

They all have_ legs.

Try to get hold of a crab and look at its external characteristics.

Can you distinguish between a head, a thorax and an abdomen? (Tip: the abdomen of a crab is folded underneath its body)

_ _

What does the skin-covering feel like? _

_ _

What does the front pair of legs look like? _

_ _

1.10.5.3.1 Describe

the eyes: _

the mouthparts: _

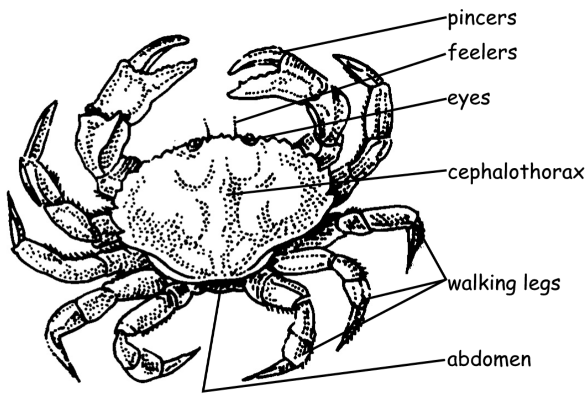


Figure 1.14

1.10.5.3.2 Build

The body of the crab consists of a cephalothorax and an abdomen. The abdomen is small and is folded underneath the cephalothorax. The following are found on the cephalothorax:

- Five legs, of which the front pair has pincers;
- Two eyes on stalks;
- Two feelers; and
- Mouthparts.

The skin covering (exoskeleton) is hard and like plastic. It consists of chitin that is strengthened with calcium.

1.10.5.3.3 Movement

Crabs move sideways and are very agile. Have you ever tried to catch one on the beach? It should not be very difficult for them to catch their prey!

1.10.5.3.4 Feeding

Crabs are meat eaters (carnivores) and catch their prey with their pincers, with which they hold the food while eating it.

1.10.5.3.5 Respiration

Crabs breathe with their gills and therefore are dependent on water. However, the gills are situated in gill-chambers that are filled with water all the time. Crabs therefore can also breathe on land.

Research assignment

Determine what is meant by the term respiration. Refer specifically to gas exchange and the gases involved. Then compare the earthworm, grasshopper, spider and crab with regard to their breathing. Make use of simple illustrations. Do the assignment on a loose sheet of paper that can be placed in your portfolio. Explain which of the animals will be able to survive under the greatest variety of conditions.

1.10.5.3.6 Maintaining a water balance

The exoskeleton of the crab prevents excessive water from moving into the body (when they are in water) or out of the body (when they are on land).

1.10.5.3.7 Reproduction

The crab lays eggs that hatch in the space between the abdomen and the cephalothorax. The young look just like the adults when they hatch.

1.10.6 The crab and other crustaceans in the ecosystem

Crabs and other crustaceans are meat eaters and form an important link in the food chain. They are adapted to live in water, but land crabs can survive out of the water for long periods.

Test your knowledge:

The crab

has _____ legs;

breathes with _____ are found in _____

that are filled with _____

has an _____ that is strengthened by _____

that occurs in the chitin;

_____has the following in common with spiders but not with insects:

1.10.7 ASSESSMENT

Learning Outcome 1: The learner will be able to act confidently on curiosity about natural phenomena, and to investigate relationships and solve problems in scientific, technological and environmental contexts.

Assessment Standard 1.1: We know this when the learner plans investigations;

Assessment Standard 1.2: We know this when the learner conducts investigations and collects data;

Assessment Standard 1.3: We know this when the learner evaluates data and communicates findings.

Learning Outcome 2: The learner will know and be able to interpret and apply scientific, technological and environmental knowledge.

Assessment Standard 2.3: We know this when the learner interprets information.

1.10.8

1.11 General Science[11]

1.11.1 NATURAL SCIENCES

1.11.2 Life and Way of Living

1.11.3

1.11.4 EDUCATOR SECTION

1.11.4.1 Memorandum

No questions or answers.

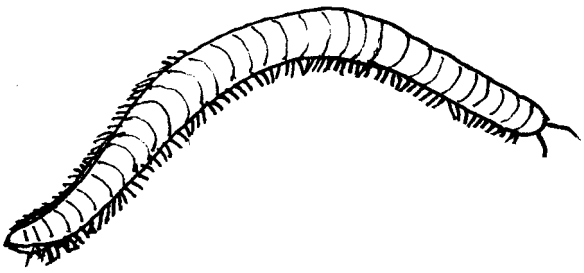
1.11.5 Leaner Section

1.11.5.1 Content

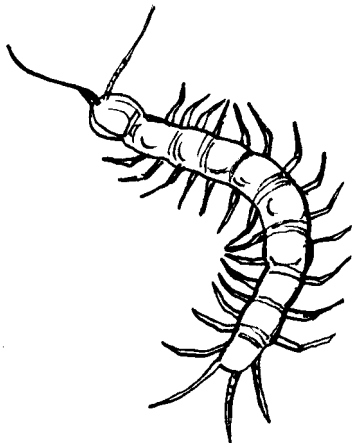
1.11.5.2 ACTIVITY 11: To compare the millipede and the centipede [LO 2.1]

1.11.5.3 MILLIPEDES AND CENTIPEDES

We will not study examples of these animals in great detail. However, it is important to remember that they play an important role in the ecosystem. Let us compare them:



Millipede



Centipede

[11] This content is available online at <http://cnx.org/content/m19896/1.1/>.

Table 1.4

	Millipedes	Centipedes
Build	Many segments, round	Many segments, flat
Number of legs	4 on each segment	2 on each segment
Food	Rotting plant material	Insects, earthworms and snails
Where they live	Amongst dead plant material on the ground	Under old tree stumps and amongst dead leaves on the ground
When they are active	In the day	At night

Table 1.5

1.11.6

1.11.7

1.11.8

1.11.9

1.11.10 ASSESSMENT

Learning Outcome 2: The learner will know and be able to interpret and apply scientific, technological and environmental knowledge.

Assessment Standard 2.1: We know this when the learner recalls meaningful information (at least definitions and complex facts).

1.12 General Science[12]

1.12.1 NATURAL SCIENCES

1.12.2 Life and Way of Living

1.12.3

1.12.4 EDUCATOR SECTION

1.12.4.1 Memorandum

- The garden snail
- Octopus and mussel
- Muscular foot
- Two pairs of feelers and two eyes
- The snail propels itself by means of wavelike movements of the muscular foot.
- The mouth is T-shaped, placed at the bottom part of the head.

[12]This content is available online at <http://cnx.org/content/m19897/1.1/>.

Assignments:

1. Plants that are close to the soil surface will probably grow luxuriantly. Animals that live on snails, like centipedes, birds and mice would probably look for alternative feeding areas.

2.

Earthworm	Round, elongated body facilitates making holes in the ground, carrying plant litter into the ground and ingesting it with the soil	Lives in damp soil to keep skin moist	System of tubes to control the amount of water that is taken in or lost
Locust	Can move around to look for food. Biting mouth parts for cutting up plant material	Tubes branch inside the body to provide a moist surface for gas exchange	External skeleton prevents loss of moisture. Obtains moisture from plant material
Spider	Learners simply summarise information from text.		
Crab			
Snail			

Table 1.6

3. Research assignment: assess in terms of the framework supplied in the module.

1.12.5 Leaner Section

1.12.5.1 Content

1.12.5.2 ACTIVITY 12: To study the garden snail and to compare the adaption of a few invertebrates with regard to survival [LO 1.1, LO 1.2, LO 1.3, LO 2.3, LO 2.4]

1.12.5.3 THE GARDEN SNAIL

The snail belongs to the group of *molluscs* or *Mollusca*. Can you still remember which other animals belong to this group?

The _____ and _____

It will not be difficult to find a garden snail. Look at its external build and try to answer the following questions:

The largest part of the body consists of a _____ foot.

On the head are two _____ and

two _____

Place the snail on a glass plate and when it begins to move, look through the glass from below and describe what you see (how it moves).

_____
_____
_____
_____
_____
_____

Can you see its mouth? Describe. _____
_____
_____
_____
_____
_____
_____

Lift the snail and try to look into the shell next to the body. Can you see an opening? This is the breathing opening.

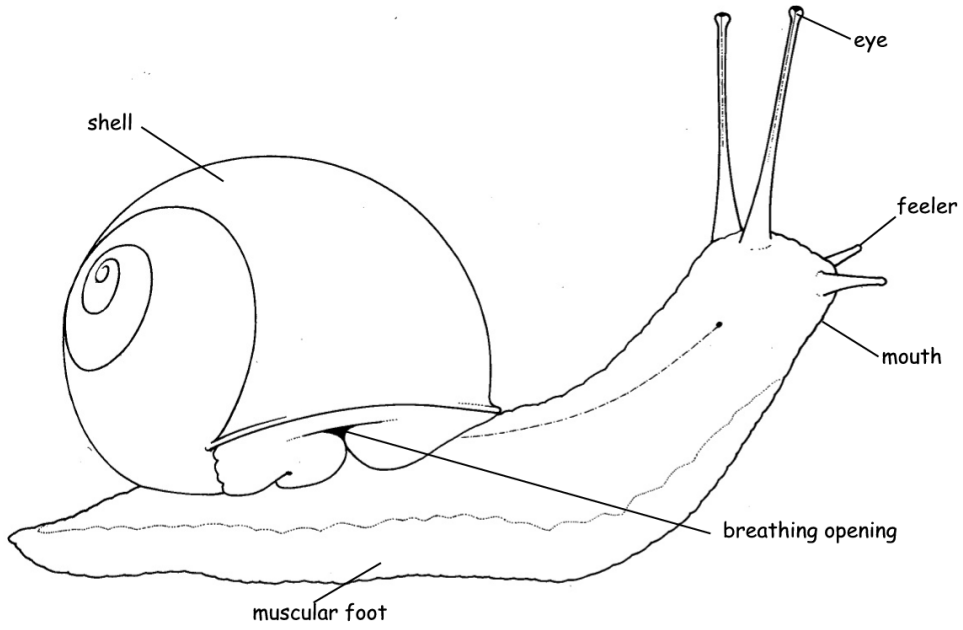


Figure 1.15

1.12.5.3.1 Build

The body of the snail consists of a head, a foot and a hump. The hump contains the organs (for reproduction, digestion, etc.) and is covered by a shell. There is a spiracle under the shell on the right-hand side. Four tentacles are found on the head. Two have eyes while the other two serve as feelers. There is a T-shaped mouth underneath the head.

1.12.5.3.2 Movement

The snail moves by means of wavelike motions in the muscle foot. Slime is secreted, making the surface smooth.

1.12.5.3.3 Feeding

The snail is plant eating and has a radula with which the plant material is grated fine.

1.12.5.3.4 Respiration

Underneath the shell, the snail has a membrane that is rich in blood vessels (the mantle) and is used for breathing. The membrane connects to the air outside via the spiracle and thereby is protected from drying out.

1.12.5.3.5 Maintaining a water balance

The snail secretes slime that protects it from drying out. When the muscle foot is pulled into the shell, the only the part of the foot outside the shell is that part against the surface on which the snail is sitting. It therefore cannot dry out.

1.12.5.3.6 Reproduction

The snail lays eggs and the young look like the adults. Snails can have both male and female sexual cells and they keep them until conditions are favourable for the survival of the young.

The snail in the ecosystem

Snails eat plants and are an important link in various food chains. They are adapted very well to life on land and can survive dry conditions, although damp periods are essential for at least part of the year.

Assignments:

1. Describe what would happen in an ecosystem if people removed all the snails.

2. Make a summary of the ways in which the invertebrates that we have studied are adapted to survive in their particular environments by completing the table below:

ANIMAL	FEEDING	RESPIRATION	WATER BALANCE
Earthworm			
Grasshopper			
Spider			
Crab			
Snail			

Table 1.7

3. **Research assignment**: Describe how you would develop a corner of 100 square metres in a zoo into a self-sustaining zoo for invertebrates (in other words, the animals do not need to be fed). Your teacher will evaluate your project in terms of the following:

- planning of the project (which invertebrates, what information is needed, etc.);
- gathering of information, e.g. on the conditions that need to be created for the animals to be able to live;
- design of the zoo; and
- evaluation of the design.

1.12.6 ASSESSMENT

Learning Outcome 1: The learner will be able to act confidently on curiosity about natural phenomena, and to investigate relationships and solve problems in scientific, technological and environmental contexts.

Assessment Standard 1.1: We know this when the learner plans investigations;

Assessment Standard 1.2: We know this when the learner conducts investigations and collects data;

Assessment Standard 1.3: We know this when the learner evaluates data and communicates findings.

Learning Outcome 2: The learner will know and be able to interpret and apply scientific, technological and environmental knowledge.

Assessment Standard 2.3: We know this when the learner interprets information;

Assessment Standard 2.4: We know this when the learner applies knowledge in a variation of a known situation.

1.13 General Science[13]

1.13.1 NATURAL SCIENCES

1.13.2 Life and Way of Living

1.13.3

1.13.4 EDUCATOR SECTION

1.13.4.1 Memorandum

1. Each organism is adapted for a particular way of life. In this way many organisms are able to live together without having to compete for food

2. Organisms are changing continually in an effort to improve their adaptation to the environment.

3. Changes in the environment.

4. The temperature is rising.

5. No. Some will probably become extinct.

6. They will have to adapt to the changes. Their ability to adapt will depend on the degree and tempo of changes in the environment.

The extinction of the dinosaurs: Discuss drastic changes such as the arrival of the ice age with the learners and mention the speed with which it occurred, etc. Encourage them to collect information and to bring it to the class.

Human beings can contribute to it through disruption of the natural balance, e.g. by destroying forests, pollution, and extermination of particular animal species.

1.13.5 Leaner Section

1.13.5.1 Content

1.13.5.2 ACTIVITY 13: To apply conceptual knowledge, to arrive at conclusions and to dare make predictions [LO 2.3, LO 2.4]

1.13.5.3 DIVERSITY AND CHANGE

You now know that a large variety of plants and animals occur in ecosystems. Try to answer the following questions:

1. Why is there a variety (diversity) of plants and animals (why do plants differ from one another and why do animals differ from one another)?

_____
_____
_____
_____
_____

2. Will the plants and animals that are alive today remain unchanged forever or will they gradually change? Explain your answer.

[13]This content is available online at <http://cnx.org/content/m19898/1.1/>.

_____
_____
_____
_____
_____

3. What causes plants and animals to change?

_____
_____
_____
_____
_____

4. Name one non-living factor that currently is busy changing and that eventually will cause the nature of ecosystems all over the world to change.

_____
_____
_____
_____
_____

5. Will all the plants and animals survive the change? _____

6. What will the plants and animals have to do to survive the change?

_____
_____
_____
_____
_____

Plants and animals differ from one another because they have adapted to survive under specific conditions. If the conditions change permanently, the plants and animals must adapt to the change. The species that succeed in changing survive the change. Species that cannot change die out.

Dinosaurs are examples of extinct animals.

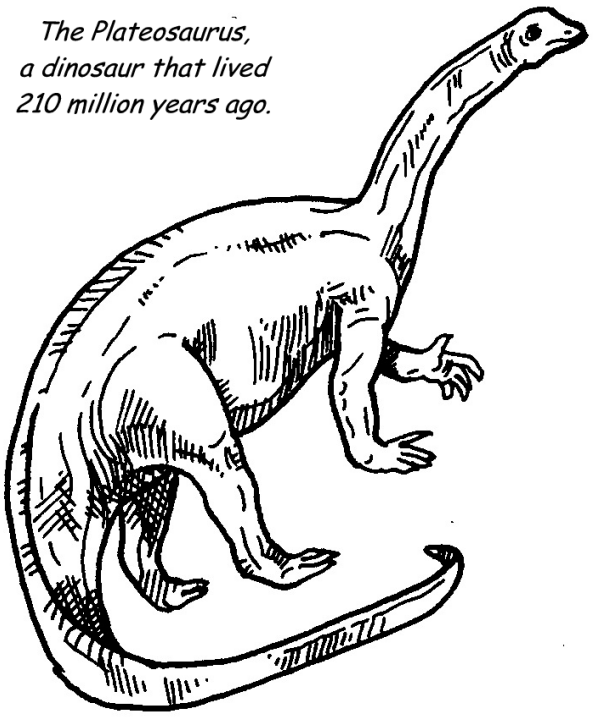


Figure 1.16

Try to determine what change caused the dinosaurs to become extinct.

Can people contribute to a permanent change in conditions on earth? Describe.

_____
_____
_____
_____
_____
_____
_____

1.13.6 ASSESSMENT

Learning Outcome 2: The learner will know and be able to interpret and apply scientific, technological and environmental knowledge.

Assessment Standard 2.3: We know this when the learner interprets information;

Assessment Standard 2.4: We know this when the learner applies knowledge in a variation of a known situation.

Chapter 2

Term 2

2.1 General Science[1]

2.1.1 NATURAL SCIENCES

2.1.2 Energy transfers and forces

2.1.3

2.1.4 EDUCATOR SECTION

2.1.4.1 Memorandum

Any suitable/relevant definition/meanings are acceptable.

2.1.5 Leaner Section

2.1.5.1 Content

2.1.5.2 1. What is energy

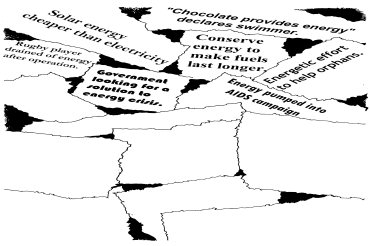


Figure 2.1

[1] This content is available online at <http://cnx.org/content/m19899/1.1/>.

2.1.5.3 ACTIVITY 1: To understand the use of the term "energy" in a broad sense [LO 2.1]

Read the above newspaper headlines attentively. The word energy occurs in each one. Discuss the meaning of this word in your groups.

(a) Write your own definition for the word.

_____
_____
_____

(b) Discuss three different meanings of the word as used in the headlines.

(i) _____
(ii) _____
(iii) _____

Well, it was not that easy to define the word, was it? When a scientist has to define something, he or she writes a brief, concise sentence that sums up the most important aspects of that thing. The following probably provides the best definition of energy:

2.1.6 ENERGY IS THE ABILITY TO DO WORK

- From where do we get the energy to do our work or to practise sport?

_____
_____

One of the newspaper headlines quotes a swimmer saying that chocolate provides energy.

2.1.7 Assessment

Learning Outcome 2: The learner will know and be able to interpret and apply scientific, technological and environmental knowledge.

Assessment Standard 2.1: We know this when the learner recalls meaningful information (at least definitions and complex facts);

2.1.3: explains how magnetic forces affect different materials

2.2 Natural Science[2]

2.2.1 NATURAL SCIENCES

2.2.2 Energy transfers and forces

2.2.3 EDUCATOR SECTION

2.2.3.1 Memorandum

1. Kilojoules.
2. Is determined by one's mass, age and energy consumption.
3. Such a person will not have enough energy to do well, seeing that he/she has not eaten anything.

2.2.4 Leaner Section

2.2.4.1 Content

2.2.4.2 ACTIVITY 2: To collect information on nutritional value in foodstuffs [LO 1.2]

Collect some wrappers or packaging from foodstuffs. Study the information provided on these:

[2] This content is available online at <http://cnx.org/content/m19903/1.1/>.

1. What is the unit of measurement for energy? _____
2. How many of these units should you take in daily? _____
3. Try to explain why someone who is on a hunger strike should not be selected to take part in a marathon.

_____
_____
_____
_____
_____
_____

2. Where does energy come from?

We obtain almost all energy indirectly from the sun. The sun radiates heat and light and still retains enough nuclear power to continue shining for the next 5 000 million years.

Figure 2.2

A bus or a train uses **fuel** to transport passengers from one point to another in the same way that a person uses the sun as a source of energy.

Fuel is the substance in which energy is contained.

2.2.5 Assessment

Learning Outcome 1: The learner will be able to act confidently on curiosity about natural phenomena, and to investigate relationships and solve problems in scientific, technological and environmental contexts.

Assessment Standard 1.2: We know this when the learner conducts investigations and collects data: organises and uses apparatus/equipment or sources to gain and record information.

1.2.1: tests two or more items and compares results;

1.2.2: uses a specific procedure for observations.

2.3 Natural Science[3]

2.3.1 NATURAL SCIENCES

Energy transfers and forces

2.3.2 EDUCATOR SECTION

2.3.2.1 Memorandum

3. Flashlight of camera - battery

[3]This content is available online at <http://cnx.org/content/m19904/1.1/>.

4. Paraffin heater - paraffin
5. Gas heater - gas
6. Hair drier - electricity
7. Windmill - wind etc.

Leaner Section

2.3.2.2 Content

2.3.2.3 ACTIVITY 3: To identify the sources of energy of common items [LO 1.2]

Think of some of the items in your homes and of any other things that are able to perform some kind of movement. Then do the following activity with a partner by trying to complete the list:

ITEM	SOURCE OF ENERGY
car	petrol/diesel
train	electricity/coal
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Table 2.1

3. Fuels

The plants and animals that existed millions of years ago absorbed the sun's energy while they were growing. They were buried under the layers of rock that eventually formed over them. Then their remains were gradually changed into oil, coal and various gases by means of chemical reactions. These fuels are known as **fossil fuels**. Oil, coal and gases are **non-renewable**, i.e. they cannot be replaced. In addition, they have to be mined from underground reserves and burning them damages our environment and our health. One non-renewable energy source that is not derived from fossils, is nuclear power. Some metals, like uranium, release enormous amounts of energy when they undergo nuclear fission. Nuclear power is utilised for manufacturing electricity, e.g. at the nuclear power station at Koeberg where electricity is generated for the use of the inhabitants of Cape Town. A small amount of nuclear power produces large amounts of nuclear fuel and causes very little environmental pollution. At present also large amounts of nuclear fuel are available. Nuclear power stations have to be built near the sea, because they need great amounts of water for cooling. This means that the energy sometimes has to be transported over long distances. Radioactive radiation can lead to health risks and it takes hundreds of years for radioactive nuclear waste to lose its radioactivity. Such waste therefore has to be buried underground in special containers for many years. Nuclear power, however, does not cause acid rain or contribute to the greenhouse effect, which is what fossil fuels do.

Because these non-renewable fuels are not expected to be available in the future, we need to conserve energy and begin to make use of alternative energy sources like the sun, water, wind, waves, tides and bio-gases for power. Great progress has already been made with the development of these forms of energy.

2.3.3 Assessment

Learning Outcome 1: The learner will be able to act confidently on curiosity about natural phenomena, and to investigate relationships and solve problems in scientific, technological and environmental contexts.

Assessment Standard 1.2: We know this when the learner conducts investigations and collects data: organises and uses apparatus/equipment or sources to gain and record information.

2.4 To list fuels and their uses[4]

2.4.1 NATURAL SCIENCES

2.4.2 Energy transfers and forces

2.4.3 EDUCATOR SECTION

2.4.3.1 Memorandum

(a) Petrol – motor-car
Gas – stove
Coal – steam locomotive
Wood – fire to provide heat
Crude oil – aeroplane fuel is derived from it
(b) Wind-propelled devices – wind farm
Engines that move by means of used cooking-oil
Solar heating for warmth
(c) Advantages and disadvantages of nuclear fuels and fossil fuels.
(i) Fossil fuels

Advantages	Disadvantages
Quite readily available.	Causes air pollution – emits smoke and harmful gases.
Can easily be converted to energy.	Presents a fire hazard.
Relatively inexpensive.	Mining defaces the environment.

Table 2.2

(ii) Nuclear fuels

Advantages	Disadvantages
A great deal is available.	Health risks caused by radioactive eradiation.
Minimal pollution of the environment.	Energy must be transported over long distances, seeing that power stations have to be built near the coast because of the water cooling systems that are used.

continued on next page

[4]This content is available online at <http://cnx.org/content/m19905/1.1/>.

A small amount produces a great deal of energy.	Radioactive waste must be stored safely for years until the radioactivity disappears.

Table 2.3

Leaner Section

2.4.3.2 Content

2.4.3.3 ACTIVITY 4: To list fuels and their uses [LO 1.3]

(a) Name five common fuels and one use of each:

(b) It is very important for people to find other sources of energy. Try to suggest ways in which people can use energy differently or make use of other sources, e.g. electric cars.

(c) Name three advantages and three disadvantages of:
(i) Fossil fuels

ADVANTAGES	DISADVANTAGES
1.	1.
2.	2.
3.	3.

Table 2.4

(ii) Nuclear fuels

ADVANTAGES	DISADVANTAGES
1.	1.
2.	2.
3.	3.

Table 2.5

(d) Consider the sources of energy that we have been discussing and then draw up a list to show how you could conserve energy, e.g. by switching off the lights in the classroom when the sun is shining.

2.4.3.4 4. Forms of Energy

The human body does not use fuel (food) in the form in which we take it. The food is broken down into simple substances that are conserved in the muscles, in the particular form that can be used by the muscles. There therefore is energy in the substances that are stored in the muscles. Energy that is stored in chemical substances like food and fuel is known as chemical energy. All fuels therefore contain chemical energy.

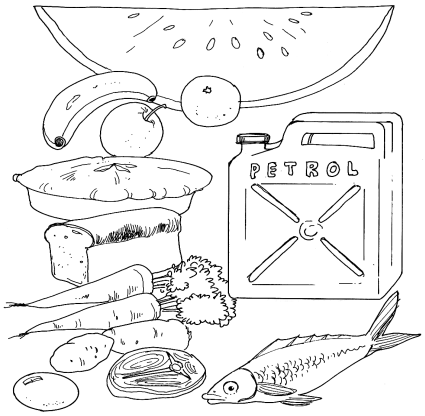


Figure 2.3

Chemical energy is released when some reaction occurs. If coal is burnt, for instance, it releases heat that can then be used to generate steam for a steam locomotive.

Heat energy is used every day. We need it to cook our food and to keep warm.

Figure 2.4

Heat energy boils the water in the locomotive's kettle and this forms steam.The steam drives the locomotive.

The sun provides us with light, as do fuels and electricity. When electricity flows through the filament in a light bulb, the wire is heated and glows. It releases **lightenergy**, as well as a small amount of heat energy. Some worms, fireflies and fish also radiate light energy.

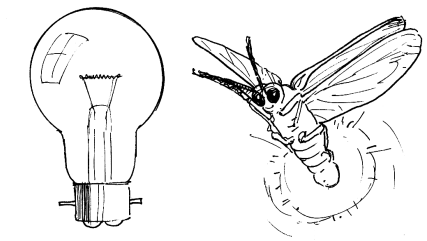


Figure 2.5

Kinetic energy results from movement. Moving water can turn a water wheel, while wind can drive a wind pump.

Figure 2.6

Energy that is stored in things and waiting to be released by some means or other is called potential energy. The spring of an air gun that is loaded has the ability to fire. We therefore say that the loaded spring has potential energy.

Figure 2.7

Figure 2.8

2.4.4 Assessment

Learning Outcome 1: The learner will be able to act confidently on curiosity about natural phenomena, and to investigate relationships and solve problems in scientific, technological and environmental contexts.

Assessment Standard 1.3: We know this when the learner evaluates data and communicates findings: generalises in terms of relevant aspects and describes how the data support the generalisation.

2.5 To describe forms of energy[5]

2.5.1 NATURAL SCIENCES

Energy transfers and forces

2.5.2 EDUCATOR SECTION

2.5.2.1 Memorandum

a) Electrical energy / sound energy / light energy.
b) Kinetic energy / potential energy.
c) Light energy.
d) Electrical energy / light energy / heat energy.
e) Kinetic energy / heat energy.
f) Chemical energy / heat energy / light energy.

2.5.3 Leaner Section

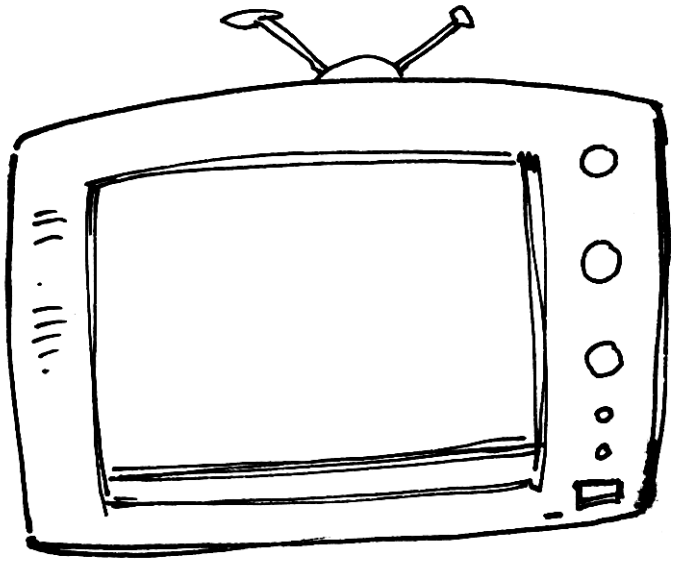
2.5.3.1 Content

2.5.3.2 ACTIVITY 5: To describe forms of energy [LO 2.3]

Label the following sketches by naming the energy source that is depicted.

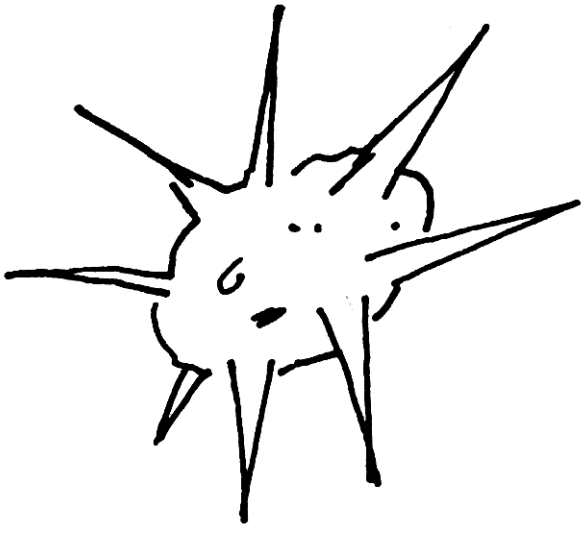
[5]This content is available online at <http://cnx.org/content/m19907/1.1/>.

(a)



Television

(b)



"Jack-in-the-box"

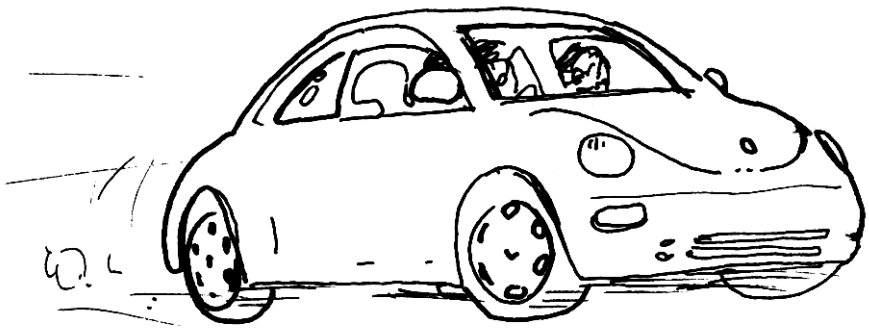
(c)

Table 2.6

(a)

Lightning

(e)



Moving vehicle

(f)

Table 2.7

(a) _____
(b) _____
(c) _____
(d) _____
(e) _____
(f) _____

2.5.3.3 5. The transfer of energy

(a) Conduction

Conduction occurs when heat moves through solid substances. Take a length of wire and hold it over a flame. What do you discover after a little while?

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

The heat was transferred to your hand by means of conduction. Metals like copper, iron and aluminium are better conductors of heat than non-metals such as wood, water and cork. Particular metals also conduct heat faster than others.

Paste or draw such materials here.

Figure 2.9

2.5.4 Assessment

Learning Outcome 2: The learner will know and be able to interpret and apply scientific, technological and environmental knowledge.

Assessment Standard 2.3: We know this when the learner interprets information by identifying key ideas in text, finding patterns in recorded data, and making inferences from information in various forms (e.g. pictures, diagrams, text).

2.6 To compare the conductivity of various substances[6]

2.6.1 NATURAL SCIENCES

2.6.2 Energy transfers and forces

2.6.3 EDUCATOR SECTION

2.6.3.1 Memorandum

a)

- Iron
- Copper
- Aluminium
- Lead

All four are good conductors, but copper, for example, is a better conductor than iron. Determine positions by doing an experiment. Try to use laboratory rods that are of the same size.

(b) An eiderdown (or down duvet) keeps one warm because body heat is poorly conducted by it. The air between the down is also a poor heat conductor. Bricks also have tiny holes that are filled with air. That makes a brick a poorer conductor of heat than for example copper, which is more solid/compact.

(c)

(i) Clay.

(ii) It conducts heat poorly from outside; therefore it will remain cooler inside than outside.

(iii) Wool is a poor conductor and therefore it keeps the body heat inside.

(iv) The learner should choose a good conductor for the bottom of the pot especially, in order to get the heat to the contents of the pot rapidly to speed up the preparation time of the contents. He/she should choose a poor conductor for the handles of the pot, so that one can handle the pot without having to use potholders or a cloth.

(v) Water is a poor conductor.

(vi) Tins are made of aluminium, which is a better conductor than glass.

2.6.4 Leaner Section

2.6.4.1 Content

2.6.4.2 ACTIVITY 6: To compare the conductivity of various substances [LO 2.2]

(a) Test the following metals by warming them in a flame or in boiling water. Let each member of the group hold a different metal rod. Report it as soon as the heat reaches your hand. Arrange the metals in such a manner that the metal that is the fastest conductor – the one that gets hot first – is placed in the first position.

Metal	Position
Iron	_ _
Copper	_ _
Aluminium	_ _
Lead	_ _

Table 2.8

[6] This content is available online at <http://cnx.org/content/m19908/1.1/>.

(b) Why is it that some substances are better conductors than other substances?

(c) Use your knowledge of conduction to answer the following questions.

(i) Which metal would you use to build a hut that needs to be cool in summer – clay or corrugated iron?

(ii) Why have you chosen this as the building material?

(iii) Have you ever thought about the reason for wearing woollen clothing in winter? Try to explain why winter garments contain wool.

(iv)You have an opportunity to design a pot for cooking food. Which materials would you use, and why? (Remember that a pot also needs handles!)

(v) Why do we put a bottle of cool drink in cold water when we want to keep it cool?

(vi) Try to explain why cool drink in a bottle would remain cold longer than cool drink in a tin.

2.6.5 Assessment

Learning Outcome 2: The learner will know and be able to interpret and apply scientific, technological and environmental knowledge.

Assessment Standard 2.2: We know this when the learner categorises information: compares features of different categories of objects, organisms and events.

2.7 To explain convection as a natural phenomenon[7]

2.7.1 NATURAL SCIENCES

2.7.2 Energy transfers and forces

2.7.3 EDUCATOR SECTION

2.7.4 Memorandum

Observations:

(i) The smoke rises.

(ii) The smoke rises.

(iii) The smoke rises.

Conclusion:

Hot air rises.

During the day the land heats up more rapidly than the sea. The warm air above the land rises. Cooler air above the sea flows to the land to fill the place of the warm air. This is how sea winds originate.

At night the land cools down more rapidly than the sea. Therefore the air above the sea is warmer and rises. Cooler air from above the land flows to the sea to take the place of the warmer air. This is how a land-wind (offshore wind) originates.

2.7.5 LEANER SECTION

2.7.6 Content

2.7.6.1 ATIVITY: To explain convection as a natural phenomenon [LO 1.2, LO 1.3]

(b) Convection

Convection is the main way in which heat moves through liquids. Water is a poor conductor of heat, but a kettle does manage to let water boil quickly. The reason is that liquids are able to move. Water rises when it becomes warm. The colder water then sinks down to take the place of the warmer liquid that is rising. The accompanying illustration shows how the circular movement, the convection current, distributes the warmth through the liquid until all the water is hot enough to come to a boil (100 °C – boiling point for water at sea level).

[7] This content is available online at <http://cnx.org/content/m20158/1.1/>.

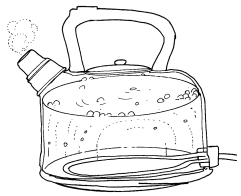


Figure 2.10

Although air is a poor conductor of heat, it is possible to heat a room with the help of a heater. Take a burning candle. Note the direction of the smoke while you

(i) hold the candle in an upright position _____

(ii) hold the candle at an angle _____

(iii) Hold the candle upside-down _____

Have you noted your observations? What do you deduce from this?

_____
_____
_____
_____
_____
_____

As warm air rises, convection also occurs in nature. Have you ever thought about the origins of wind? Warm air rises and cold air moves to take its place.

Consider the principle of convection currents in air to help you distinguish between land and sea winds. You could make a sketch to help explain your observations.

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

(c) Radiation

The transfer of heat by means of conduction or convection requires a solid substance, a liquid or a gas. There must be some substance to transfer heat energy. Such a transfer of energy through empty space is possible through radiation. Heat energy from the sun moves through space and the earth's atmosphere and heats any object that it reaches.

If you drive along any road where you can see ahead into the distance on a hot day, it often seems as if there is water on the road. The hot tar of the road radiates heat. Using an electric heater to heat a room in winter is an example of the use of radiation in an everyday situation.

6. Conversion of energy

Which kind of energy is used when a boy hits a tennis ball?

_____
_____

_____
_____
_____
What kind of energy does the moving tennis ball have?
_____
_____
_____
_____
_____

This has probably made you suspect that energy can be changed. When there is a change in energy from one kind to another kind, we speak of the conversion of energy.

2.7.7 Assessment

Learning Outcome 1: The learner will be able to act confidently on curiosity about natural phenomena, and to investigate relationships and solve problems in scientific, technological and environmental contexts.

Assessment Standard 1.2: We know this when the learner conducts investigations and collects data: organises and uses apparatus/equipment or sources to gain and record information:

Assessment Standard 1.4: We know this when the learner evaluates data and communicates findings: generalises in terms of relevant aspects and describes how the data support the generalisation:

2.8 To identify various forms of energy conversion[8]

2.8.1 NATURAL SCIENCES

Energy transfers and forces

2.8.2 EDUCATOR SECTION

2.8.3 Memorandum

(a)

- Chemical → electrical
- Electrical → kinetic
- Kinetic →heat energy
- Heat energy →chemical

(b)
(i) Electrical energy – sound energy
(ii) Chemical energy – kinetic energy
(iii) Heat energy – electrical energy
(iv) Electrical energy – light energy / sound energy
(v) Electrical energy – heat energy
(vi) Electrical energy – sound energy
(c) Toy tractor.

- Potential energy – kinetic energy

[8] This content is available online at <http://cnx.org/content/m20310/1.1/>.

2.8.4 Learner Section

2.8.5 Content

2.8.5.1 ACTIVITY: To identify various forms of energy conversion [LO 2.3, LO 2.4]

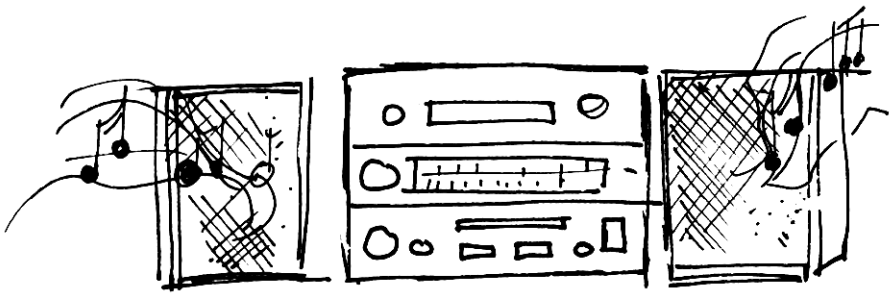
Conversion of energy in motorcar engines

(a) Chemical energy is converted to electrical energy in the battery of a car. In the engine, the electrical energy is converted to kinetic energy (movement energy). When the engine overheats, the kinetic energy is converted to heat energy and when the engine cools down again, the heat energy is converted to chemical energy.

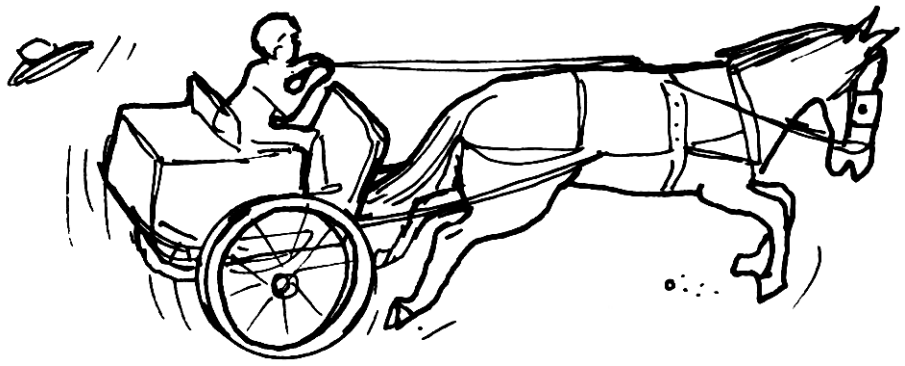
Identify the various energy transfers by underlining.

(b) Examine the illustrations that follow and indicate what kind of energy conversion has taken place.

(i)



(ii)



(iii)

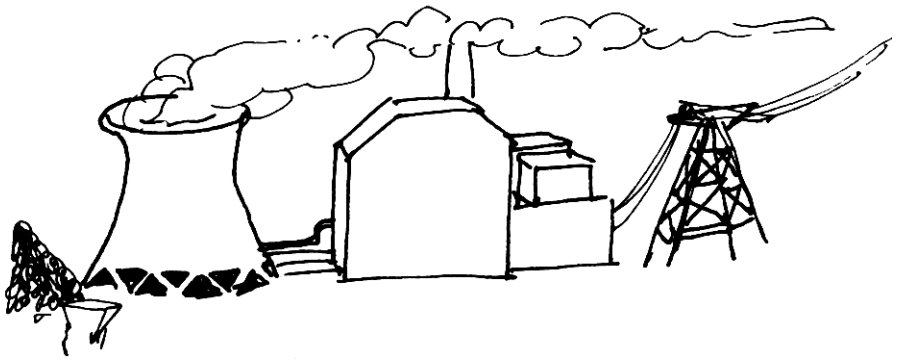
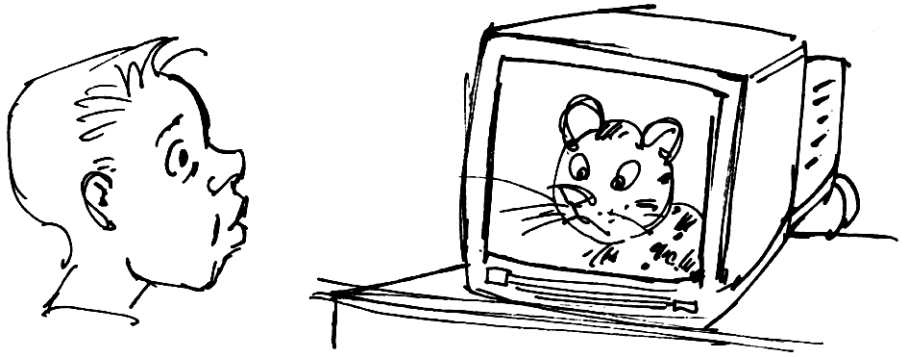
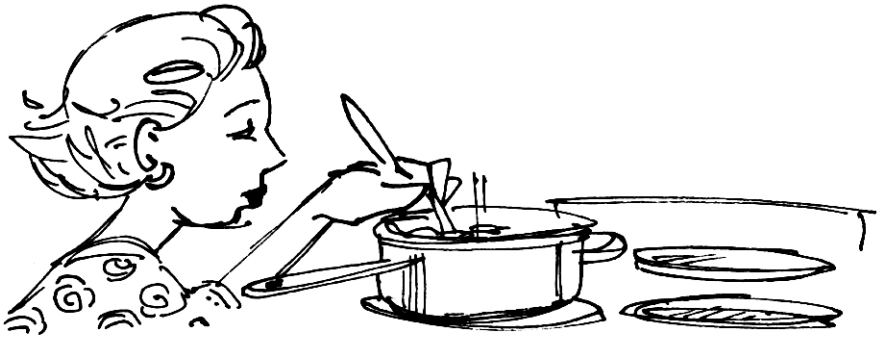


Table 2.9

(iv)



(v



(vi)

Table 2.10

(i) _____
(ii) _____
(iii) _____
(iv) _____
(v) _____

(vi) _____

(c) Having fun with energy conversion

Making your own toy "tractor".

REQUIREMENTS:

- Empty cotton reel
- Rubber band
- 2 toothpicks
- Candle wax disk cut from a round candle, with a hole in the middle

METHOD:

1. Thread the rubber band through the hole in the cotton reel.
2. Secure the rubber band in the hole by inserting half a toothpick through the loop of the protruding rubber band.
3. Place the candle wax disk against the opposite end of the cotton reel, threading the rubber through the hole in the wax disk.
4. Insert the remaining toothpick into the second loop of the rubber band.
5. Wind the "tractor" by turning the second toothpick to twist the rubber band.
6. Hold the toothpick to prevent the band from unwinding and place the reel on the ground.
7. What kind of energy conversion is illustrated?

_____
_____
_____
_____
_____
_____
_____
_____

7. Energy issues

The utilisation of energy sources causes serious damage to our planet. We looked at the advantages and disadvantages of fossil and non-fossil fuels earlier in the module. One of the disadvantages of nuclear fuels is that radioactive waste material cannot be destroyed. A leakage of radioactive material would have disastrous results.

Some countries do not have oil (a fossil fuel) and have to buy oil from oil producing countries. This has to be transported in large oil tankers. These tankers frequently cause extensive oil slicks when they run aground along coastlines.

2.8.6 Assessment

Learning Outcome 2:The learner will know and be able to interpret and apply scientific, technological and environmental knowledge.

Assessment Standard 2.3: We know this when the learner interprets information by identifying key ideas in text, finding patterns in recorded data, and making inferences from information in various forms (e.g. pictures, diagrams, text);

Assessment Standard 2.4:We know this when the learner application of knowledge: applies knowledge appropriately by connecting the learnt concept to a variation of the known situation.

2.9 To emphasis the sensible use of the resources of the earth[9]

2.9.1 NATURAL SCIENCES

2.9.2 Energy transfers and forces

2.9.3 EDUCATOR SECTION

2.9.4 Memorandum

- Examples of self-assessment have been included in the module to assess the learner's contribution to the debate, and there is also a "control list" for the research assignment.

2.9.5 Leaner Section

2.9.6 Content

2.9.6.1 ACTIVITY: To emphasis the sensible use of the resources of the earth [LO 3.2]

RESEARCH ASSIGNMENT

a. Do research into the nuclear accident that occurred at Chernobyl in Russia in 1986. Write (at least one folio sheet) on the fearful effects of the tragedy with regard to the inhabitants and the environment

or

b. Find out what happens to marine life when ships leak oil. Write about it.

c. Arrange a class debate. Form two groups.

One group has to protest against nuclear power and the other group must offer arguments in favour of the use of it.

Make use of your knowledge of nuclear fuels and fossil fuels, as well as of renewable energy sources (the sun, wind and water) when you prepare your arguments.

Make use of the questionnaire that follows to assess your input.

Self AssessmentResearch				
Name : _____				
Subject : _____				
Grade : _____				
	LEARNER		EDUCATOR	
	YES	NO	YES	NO
Have you used more than one source?	_____	_____	_____	_____

continued on next page

[9] This content is available online at <http://cnx.org/content/m20318/1.1/>.

Are you sure that you have used your own words throughout?	_ _ _ _ _ _	_ _ _ _ _ _	_ _ _ _ _ _	_ _ _ _ _ _
Do you have a meaningful introduction?	_ _ _ _ _ _	_ _ _ _ _ _	_ _ _ _ _ _	_ _ _ _ _ _
Did you enjoy the assignment?	_ _ _ _ _ _	_ _ _ _ _ _	_ _ _ _ _ _	_ _ _ _ _ _
Were you able to extend your knowledge by executing the assignment?	_ _ _ _ _ _	_ _ _ _ _ _	_ _ _ _ _ _	_ _ _ _ _ _

Table 2.11

Self Assessment
Debating
Name:
Date:

	Always	Sometimes	Never
Have I stated my arguments clearly?	_ _ _ _ _ _	_ _ _ _ _ _	_ _ _ _ _ _
Did the other participants listen to my arguments?	_ _ _ _ _ _	_ _ _ _ _ _	_ _ _ _ _ _
Did I support the arguments of the other members of my group?	_ _ _ _ _ _	_ _ _ _ _ _	_ _ _ _ _ _
Could I elaborate on the arguments put forward by the other members of my group?	_ _ _ _ _ _	_ _ _ _ _ _	_ _ _ _ _ _
Did I use appropriate words?	_ _ _ _ _ _	_ _ _ _ _ _	_ _ _ _ _ _
Could I refute the arguments put forward by the other group?	_ _ _ _ _ _	_ _ _ _ _ _	_ _ _ _ _ _

Table 2.12

CONSERVATION OF ENERGY

Alternative sources of energy, e.g. wind energy, is more environment friendly but very expensive. We therefore have to continue using fossil fuels (coal, oil, gas) and wood. Although new coal and petroleum reserves are still being discovered, these will eventually be exhausted. It is therefore of great importance to use our sources of energy as effectively as possible.

Electricity is convenient and practical, but is has to be generated and this incurs costs. Electrical appliances are classified according to their use of electricity. This is measured in watt or kilowatt (1 kilowatt = 1 000 watt) Electricity accounts are calculated according to the number of units recorded by an electricity meter. This unit is a kilowatt-hour (kWh), i.e. the amount of electricity used by a one-kilowatt appliance in one hour. An automatic washing machine is usually classified as a three-kilowatt appliance. This means that one can expect an account for three units of electricity for each hour that the machine is operated.

2.9.7 Assessment

Learning Outcome 3:The learner will be able to demonstrate an understanding of the interrelationships between science and technology, society and the environment.

Assessment Standard 3.2: We know this when the learner understands sustainable use of the earth's resources: analyses information related to renewable and non-renewable sources.

2.10 To compare the energy consumption of a variety of electrical appliances[10]

2.10.1 NATURAL SCIENCES

2.10.2 Energy transfers and forces

2.10.3 EDUCATOR SECTION

2.10.4 Memorandum

(i) Refrigerator; kettle; toaster
(ii) Convection heater; fan heater; iron
(iii) Refrigerator; kettle; vacuum cleaner or toaster
(iv) Food mixer; convection heater; fan heater; filter
E.g. heaters can be replaced by isolating ceilings, carpets on cement floors, properly sealed panes, etc.

2.10.5 Leaner Section

2.10.6 Content

2.10.6.1 ACTIVITY 10: To compare the energy consumption of a variety of electrical appliances [LO 3.2]

a. Study the following and answer the questions that follow:
With one unit of electricity _____

[10]This content is available online at <http://cnx.org/content/m20319/1.1/>.

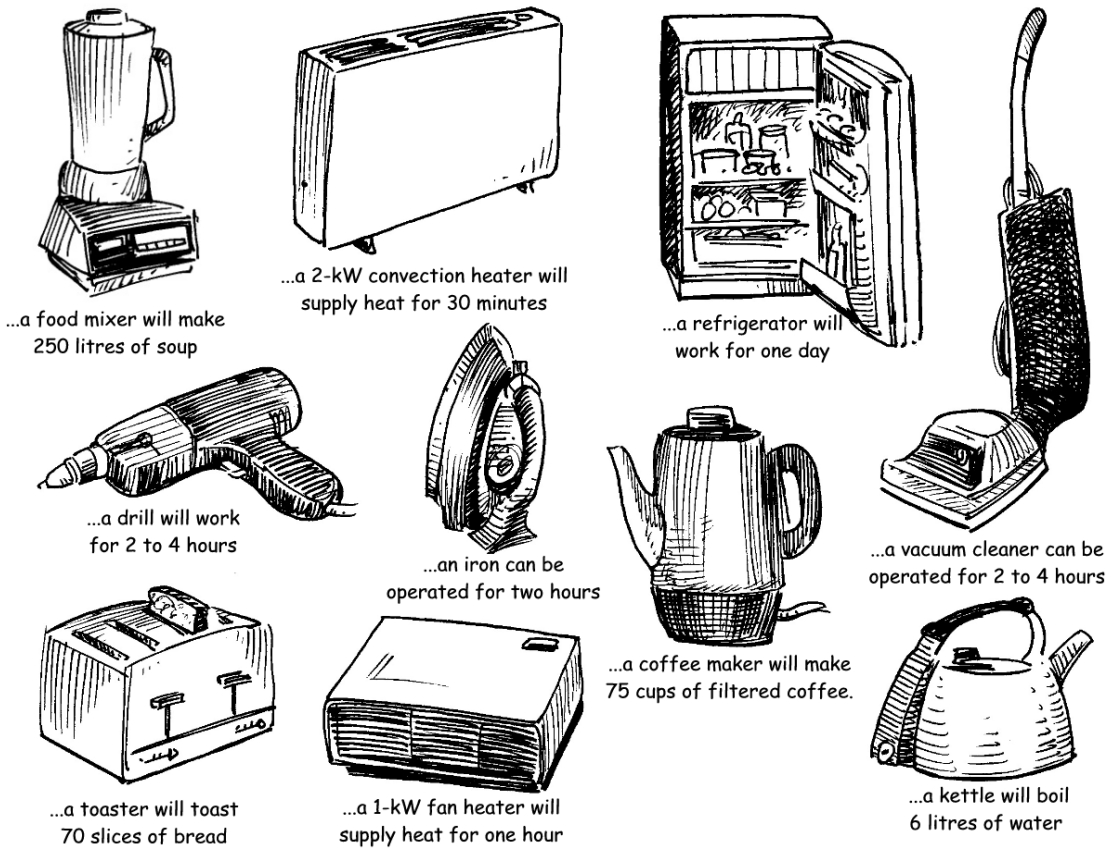


Figure 2.11

The above illustrates the working costs of some household appliances with reference to their consumption per unit of electricity.

(i) Which three appliances use the least energy?

_____

(ii) Which three appliances are the most expensive to operate?

_____

(iii) Which appliances are used most frequently in households?

_____

(iv) Which appliances would you regard as unnecessary and replaceable with other appliances that do not use as much fuel, or as altogether dispensable.

_____
_____
_____
_____
_____
_____
_____

(b) Many people in South Africa do not have access to electricity and have to use fuel wood, paraffin or gas as fuels to cook their food and warm their houses. Fuels, especially wood, are becoming scarcer and people often have to walk great distances to collect what they need. These fuels also need to be used effectively to help with conservation.

Many of the people who depend on fuel wood use open fireplaces and much heat energy is transferred into the surrounding air. Often people also use gas stoves incorrectly and waste energy.

GROUP WORK

Each group is to select a means that is used for cooking by a majority of South Africans in rural areas, e.g. an open fire, a gas stove, etc. This must be represented practically by means of a model and a report must be written on its use. The report should cover the following questions:

Which fuel is used?

- Is it easily obtainable?
- Is a particular colour recommended for the pot? If so, what is the reason for it?
- Which measures can be taken to limit heat energy being lost into the air around the pot?
- What is the cost of the fuel?

Educator's Assessment:

Criteria	1	2	3	4
Assignment: Correctly executed; complete; relevant; handed in on time				
Model: Effective; fuel indicated; creative representation				
Report: All questions addressed; reporting neat; good language use				
Co-operation within group: Effective; differences resolved; all learners involved				
DOMINANT CODE				

Table 2.13

2.10.7 Assessment

Learning Outcome 3:The learner will be able to demonstrate an understanding of the interrelationships between science and technology, society and the environment.

Assessment Standard 3.2: We know this when the learner understands sustainable use of the earth's resources: analyses information related to renewable and non-renewable sources.

2.11 To identify the effect of forces[11]

2.11.1 NATURAL SCIENCES

2.11.2 Energy transfers and forces

2.11.3 A. Forces

2.11.4 EDUCATOR SECTION

2.11.5 Memorandum

Fig 1 - A force can change the course (direction) of a moving object.

[11]This content is available online at <http://cnx.org/content/m20322/1.1/>.

Fig 2 - A force can halt a moving object.
Fig 3 - A force change the shape of an object.
Fig 4 - A force can change the speed of a moving object.
Fig 5 - A force can make an object rotate.

2.11.6 Leaner Section

2.11.7 Content

1. Contact forces
   The vehicle in the illustration has broken down and cannot move by itself. The tow truck has to pull it.

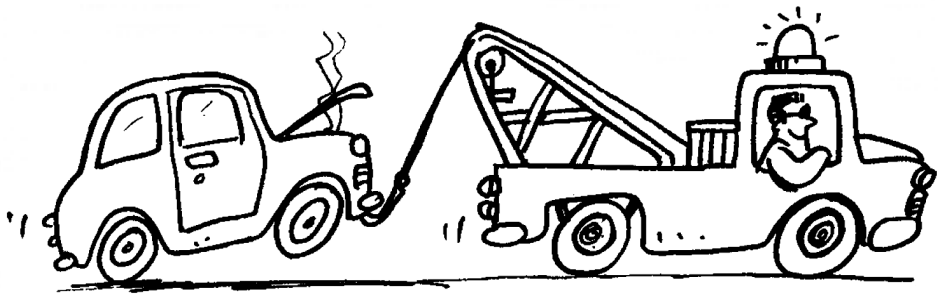


Figure 2.12

This car also cannot move by itself. The man has to push it.

When something has to be pulled or pushed, we say that we must exert force on it. You use the force of thrust to push something away from you, or the force of attraction to pull something towards you.

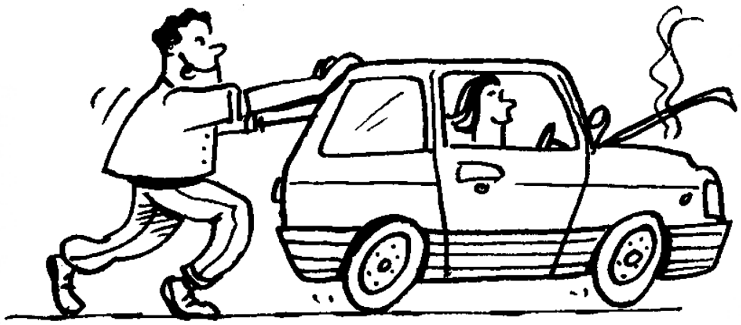


Figure 2.13

Examine the following illustrations and indicate whether they show forces of thrust or of attraction.

Figure 2.14

Figure 2.15

Figure 2.16

Figure 2.17

We cannot see force, but we know that it is there because we observe its effect. The above illustrations show that force can move a stationary object.

2.11.7.1 ACTIVITY: To identify the effect of forces [LO 1.3]

The following illustrations show more of the effect of forces. Are you able to identify them?

Figure 2.18

Fig. 1: The tennis player hits the ball away from her.

Figure 2.19

Fig. 2: The driver uses the brakes to stop the car.

Figure 2.20

Fig. 3 The force of attraction is exerted on the elastic band.

Figure 2.21

Fig. 4: The force of thrust in the same direction as the motion is exerted on the rolling ball.

Figure 2.22

Fig. 5: The athlete swings the hammer to rotate it around him
Note down your deductions:
Fig 1: _____
_____
_____
_____
Fig 2: _____
_____
_____
_____
Fig 3: _____
_____
_____
_____
Fig 4: _____
_____
_____
_____
Fig 5: _____
_____
_____
_____

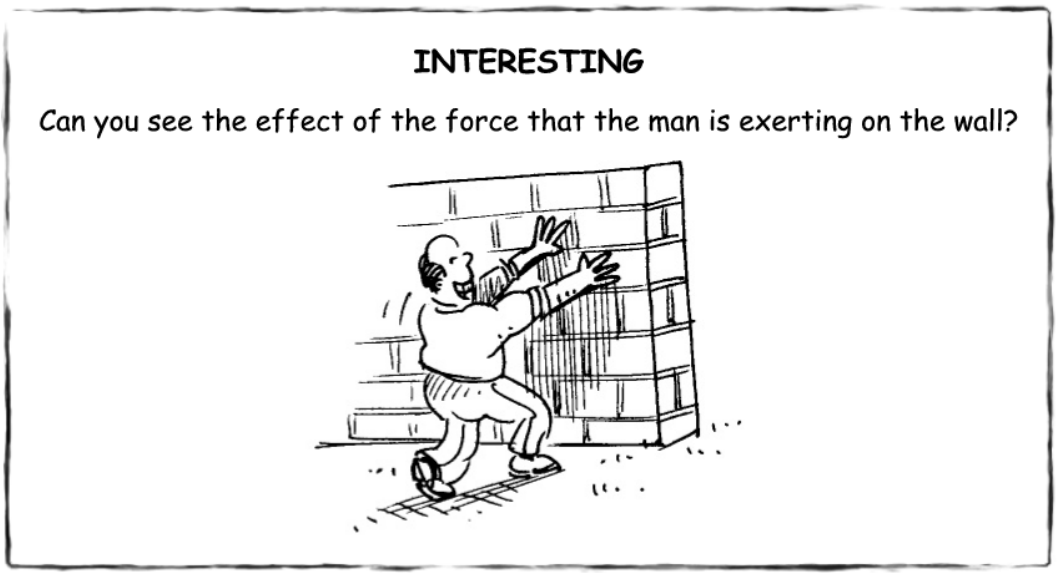


Figure 2.23

Sometimes the effect of force is not visible. When you push against a wall, you are using force, but the effect cannot be seen. But when there is an egg between your hand and the wall, you will be able to observe that you have exerted force quite plainly!

2. Forces that operate over distance:

It is even possible to bring objects into motion or to change the direction of the motion without any contact. Forces that affect objects without making contact are identified as forces that operate over distance.

Three kinds of force can have an effect without any contact with objects:

- Magnetic force
- Electrostatic force
- Gravitational force

2.11.8 Assessment

Learning Outcome 1:The learner will be able to act confidently on curiosity about natural phenomena, and to investigate relationships and solve problems in scientific, technological and environmental contexts.

Assessment Standard 1.3: We know this when the learner evaluates data and communicates findings: generalises in terms of relevant aspects and describes how the data support the generalisation.

2.12 To describe the functioning of electrostatic and gravitational force[12]

2.12.1 NATURAL SCIENCES

2.12.2

2.12.3 Energy transfers and forces

2.12.4

2.12.5 A. Forces

2.12.6

2.12.7 EDUCATOR SECTION

2.12.8 Memorandum

The learners write a paragraph on the force of gravity or on electrostatic force. They can be given source books or material to consult.

2.12.9 LEANER SECTION

2.12.10 Content

2.12.10.1 ACTIVITY: To describe the functioning of electrostatic and gravitational force [LO 2.1]

We will be finding out more about magnetism as we work through this module. So, choose one of the other two forces that are able to operate at a distance and write a paragraph to describe it and to explain how it operates.

2.12.10.2 3. Measuring force

Forces can be measured by noting their ability to stretch a spiral spring or an elastic band. Many years ago, Robert Hooke, a British scientist, discovered that the stretch of a spring is equal to the force that causes the stretch. If a particular force can stretch the spring 1 cm, a force that is three times greater will stretch the spring to 3 cm. The heavier the object, the more the spring will be stretched.

If an object is heavy, we say that the force of attraction between the earth and the object is great. Weight, therefore, is the force of the attraction that the earth exerts on the object. This means that the weight of any object can be determined by measuring the stretch of a spring.

The unit that we use for measuring force (weight) is Newton (N). The name is derived from Sir Isaac Newton, one of the greatest scientists of all time. For measuring a force, we use a spring balance calibrated in Newton. We can also refer to it as a dynamometer.

2.12.11 Assessment

Learning Outcome 2:The learner will know and be able to interpret and apply scientific, technological and environmental knowledge.

Assessment Standard 2.1: We know this when the learner recalls meaningful information: the minimum requirement is an ability to recall definitions and complex facts.

[12]This content is available online at <http://cnx.org/content/m20323/1.1/>.

2.13 To build your own dynamometer[13]

2.13.1 NATURAL SCIENCES

2.13.2 Energy transfers and forces

2.13.3 A. Forces

2.13.4 EDUCATOR SECTION

2.13.5 Memorandum

Groups can assess each other's dynamometers by determining how effectively they work. Compile a matrix in which the criteria that are to be assessed, as well as the criteria describers, are given. Allow the learners to join you in deciding about this, so that they will know exactly how the dynamometer will be assessed before the start of the project.

The weights of objects of which the weight will be determined will depend on the size of the objects that are used.

Conclusion

The greater the mass of the object, the greater the earth's gravitational force upon it.

Let us test our knowledge:

(a) A force is exerted on an object, for example by pulling or pushing it.

(b) Newton (N).

(c) Dynamometer/spring-balance.

(d) E.g. 60 kg _____mass; then your weight is ± 600N seeing that 1 kg has the weight of ± 10N.

(e) Weight is the gravitational force of the earth on an object.

(f) Electrostatic force

Gravitational force

Magnetic force

(g) Tensile force

Momentum (thrust)

Rotational force/torque (torsion)

(h) A force can make an object rotate.

A force can halt a moving object.

A force can change the speed of an object.

A force can change the shape of a moving object.

A force can change the direction of a moving object.

(i) c

(j) Rotation

2.13.6 LEANER SECTION

2.13.7 Content

2.13.7.1 ACTIVITY: To build your own dynamometer [LO 2.4]

Build your own dynamometer

Requirements:

- Wooden plank (30 mm x 300 mm)
- Screw (± 25 cm in length)
- Elastic band
- Nail

[13] This content is available online at <http://cnx.org/content/m20352/1.1/>.

- Tin can lid
- String
- White paper
- Retort stand and clamp

Step 1: Glue the white paper to the wood.

Step 2: Screw the screw in at the top of the plank.

Step 3: Suspend the elastic band from the screw and clamp the plank in the stand.

Step 4: Use the hammer and nail to pierce four holes at equal distances along the edge of the tin lid.

Step 5: Attach four pieces of string (each ± 150 mm long) to the lid, by tying them through the holes. Tie the four loose ends of string to another length of string (± 300 mm long). Then attach this longer length of string to the elastic band.

Step 6: Make a mark on the paper immediately below the elastic band. This is the O position.

Step 7: Now place the mass pieces (to a total of 102 grams) on the lid. Mark the new position of the elastic band as "1".

Step 8: Repeat step 7, increasing the mass of the mass pieces as you proceed, until you have marked 5 graduations on the paper. Avoid putting too much strain on the elastic band – if it is stretched too far, it might snap.

You have now built a simple dynamometer calibrated in Newton. 1 N is equal to ± 102 g. One kilogram is therefore equal to approximately 10 N.

Use this dynamometer or another spring balance to determine the weight of the following objects:

OBJECT	WEIGHT IN N
one pen	_____N
five such pens	_____N
your shoe	_____N
both your shoes	_____N
an object of your choice	_____N

Table 2.14

Complete:

Deduction:

The greater the_____, the greater the

_____. that the earth exerts on it.

4. Let's see what you know. Do turn back to the earlier work in the module if you are unsure of yourself. This means that you may refer to the module as a source of information.

(a) Write one sentence to explain what we mean when we speak of force.

_____

(b) What is the unit that we use for measuring weight? _____

(c) Which instrument is used to measure the weight of an object?

_____

(d) What is your mass? _____

Consider your body as an object. What is the weight of your body in Newton?_____

(e) What is weight?

_____

_____
_____
_____

(f) Name three forces that are exerted around us in nature.

_____
_____
_____
_____

(g) Name two kinds of force that can be exerted.

_____
_____
_____
_____

(h) Name five effects of forces on objects.

_____
_____
_____
_____
_____

(i) Underline the example that illustrates the force of gravity.

(i) Magnets that repel one another.

(ii) A person doing a long jump.

(iii) A spoon falling off the table and landing on the floor.

(iv) Two people running into one another.

(j) When forces cause an object to move in a circle, we say that they cause a _____ of the object.

Summative (10)

5. A journey through space

The most difficult part of space travel is escaping the Earth's gravity. Space travellers need rockets to travel to outer space. A rocket is a powerful engine that is strong enough to overcome gravity and to guide the spacecraft into space.

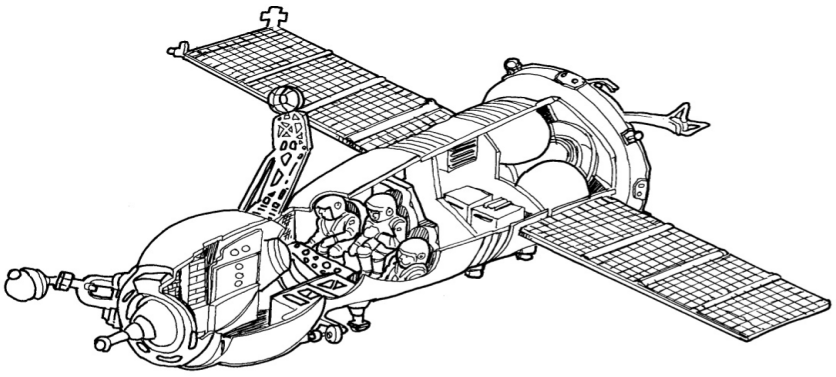


Figure 2.24

On 25 April 2002, Mark Shuttleworth became the first South African and African to undertake space travel.

Figure 2.25

2.13.8 Assessment

Learning Outcome 2:The learner will know and be able to interpret and apply scientific, technological and environmental knowledge.

Assessment Standard 2.4: We know this when the learner application of knowledge: applies knowledge appropriately by connecting the learnt concept to a variation of the known situation:

2.4.1: identifies the forms of energy that are transferred.

2.14 To report on a human achievement in science[14]

2.14.1 NATURAL SCIENCES

2.14.2 Energy transfers and forces

2.14.3 A. Forces

2.14.4 EDUCATOR SECTION

2.14.5 Memorandum

2.14.6

2.14.7 LEANER SECTION

2.14.8 Content

2.14.8.1 ACTIVITY: To report on a human achievement in science [LO 3.1]

Newspapers and magazines published many articles on Mark Shuttleworth's space travels because he can be regarded as a pioneer in this field. Use these articles as sources of information to write a report (± two folio sheets in length) on his journey. More interesting information and photographs are available on the website: http://www.africaninspace.com.

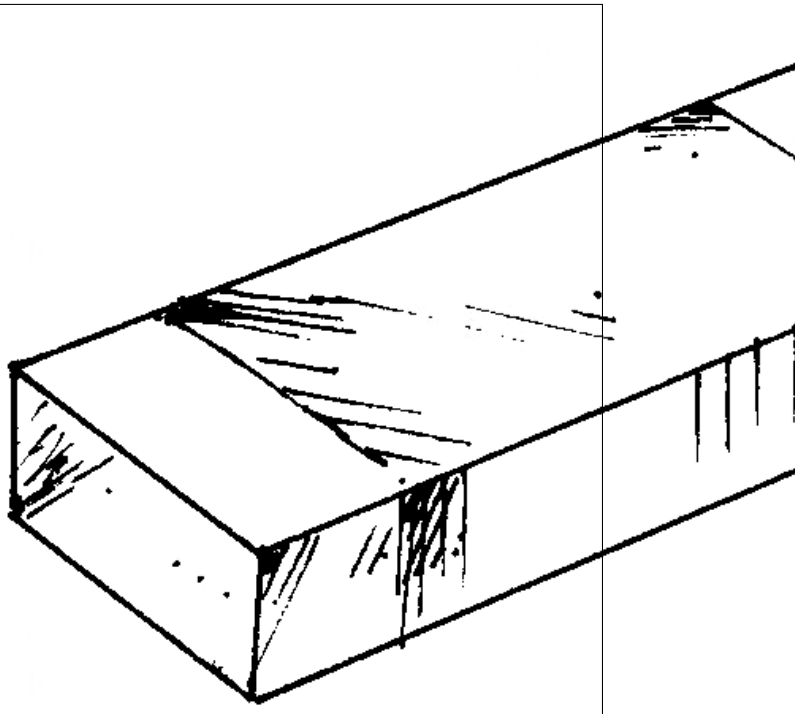
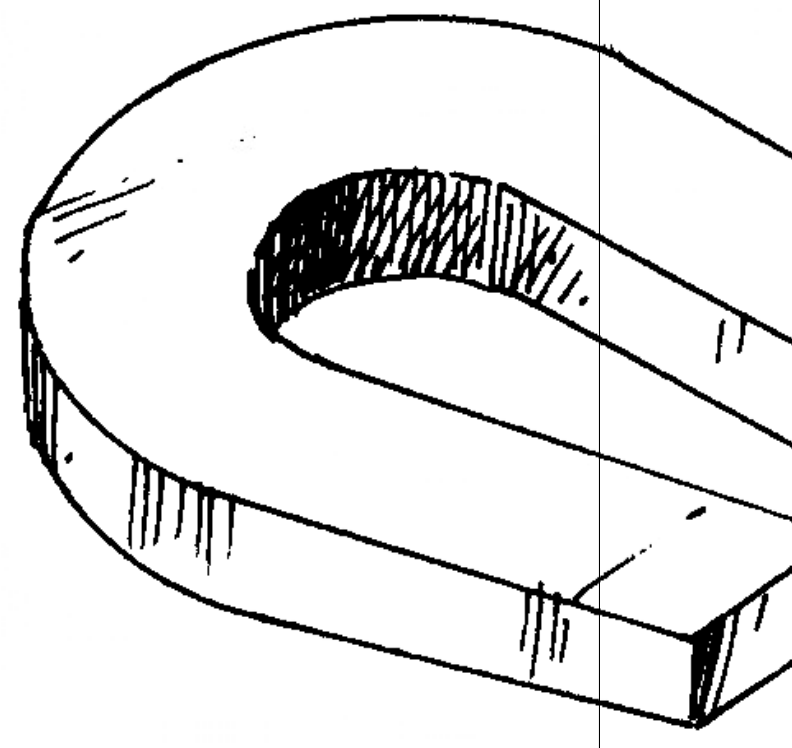
Guidelines for assembling the contents of your report:

1. Mark Shuttleworth, his dreams and ideals
2. Preparing for the journey
3. Reasons for the journey
4. The journey
5. The significance of the journey for people in general and for South Africa?

[14]This content is available online at <http://cnx.org/content/m20354/1.1/>.

B. Magnetism

It is said that the Greeks discovered a strange type of stone more than 2 000 years ago. While Magnes, a young shepherd boy, was looking after sheep one day, he realised that a strange black stone that exerted so much force on it that he could not withdraw the staff attracted the iron tip of his staff. The fable suggests that the word 'magnet' is derived from the name of this boy. Of course, we cannot verify this, but it is a fact that certain kinds of black stone attract similar stones and certain metals. Many such stones are found in the vicinity of Magnesia, in Turkey, and they are called lodestones, or magnet stones. The word 'magnet' therefore is probably derived from the name of this city. These stones are natural magnets. We nowadays use synthetic magnets made of iron or steel. These magnets are manufactured to attract objects very forcefully and to retain their magnetism for a long time. The magnets in your school's laboratory may come in any of the following four different shapes:

Bar-shaped magnets	
Horseshoe-shaped magnets	

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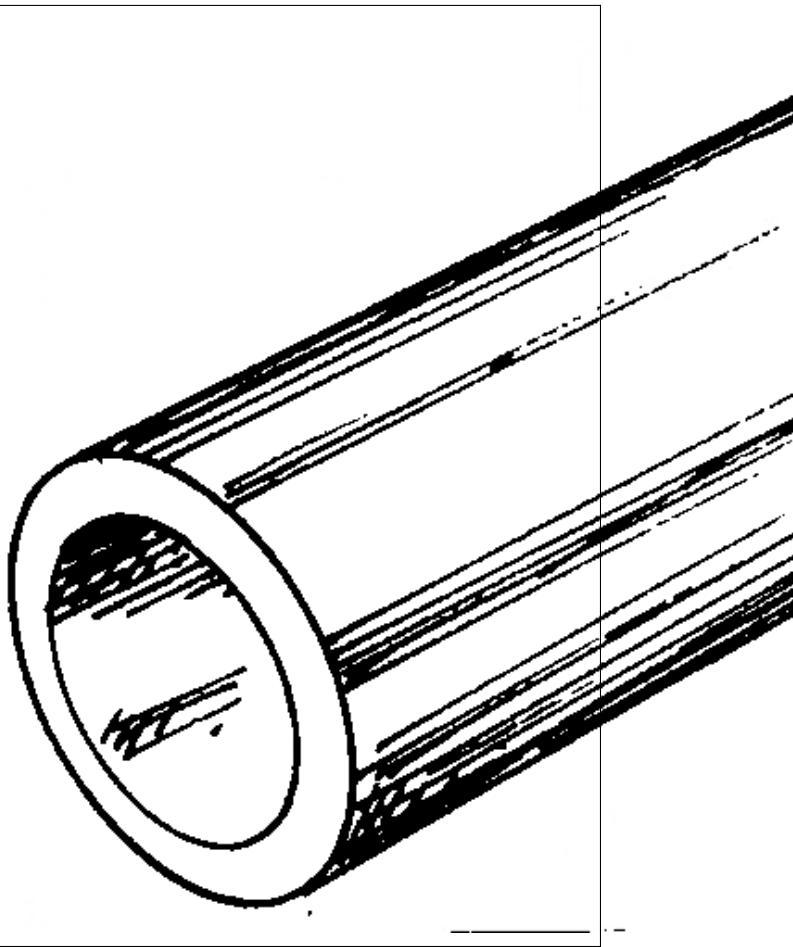
Cylindrical magnets	

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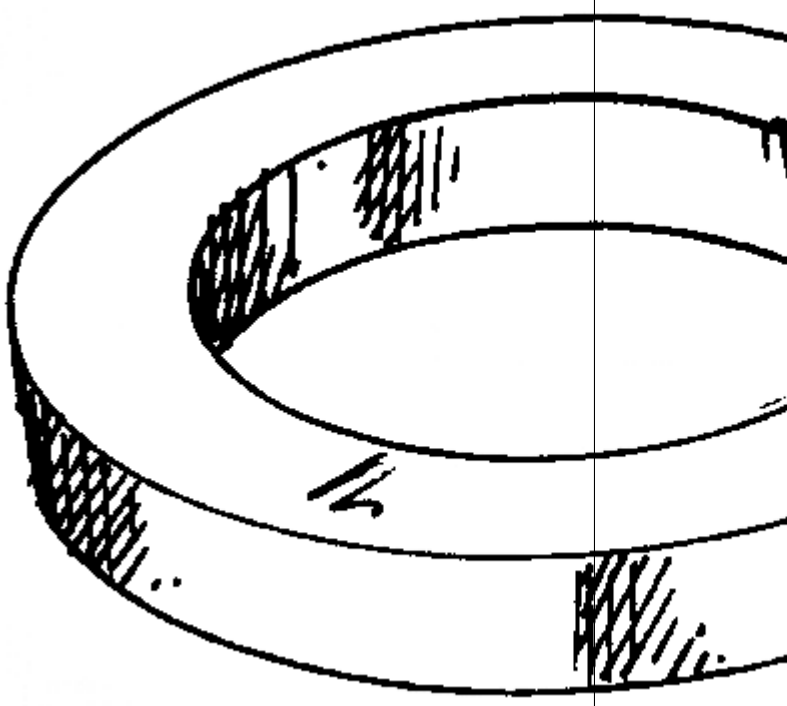
Ring-shaped magnets	

Table 2.15

Magnets have to be handled with care to prevent loss of magnetism.
Bear the following in mind when you use a magnet:

- Do not handle the magnets roughly, i.e. do not drop it or knock against it.
- Do not heat magnets.
- Always store magnets with their locking devices in position.

2.14.8.2 1. Magnetic and non-magnetic materials

Magnets do not attract all materials. The following experiment will help us to determine whether a material substance is magnetic or non-magnetic.

2.14.9 Assesment

Learning Outcome 3:The learner will be able to demonstrate an understanding of the interrelationships between science and technology, society and the environment.

Assessment Standard 3.12: We know this when the learner understands science as a human endeavour: compares different interpretations of events

2.15 To test magnetism in various substances[15]

2.15.1 NATURAL SCIENCES

2.15.2 Energy transfers and forces

2.15.3 A. Forces

2.15.4 EDUCATOR SECTION

2.15.5 Memorandum

Materials that are noted down will be determined by the objects used by the learners.
Complete:

- Magnetic materials.
- Iron, steel, nickel or cobalt.
- Non-magnetic materials.
- Cork, plastic, copper and cardboard.

2.15.6 LEANER SECTION

2.15.7 Content

2.15.7.1 ACTIVITY: To test magnetism in various substances [LO 1.2, LO 1.3, LO 2.1]

Select a variety of objects. All the members of the group should bring objects from home for testing in the class. Note down your results in the following table.

Attracted	Not attracted

Table 2.16

Complete:
A magnet attracts magnetic materials. All the objects attracted by the magnet are therefore regarded as and are _____ made of materials that contain _____, _____ _____or_____

[15]This content is available online at <http://cnx.org/content/m20356/1.1/>.

Objects that are not attracted by the magnet are referred to as _____ _____ and are made of materials such as _____', _____', _____ and

_____

2. Polarity of magnets

Take good note of what happens when your educator is busy with the following experiment:

2.15.8 Assessment

Learning Outcome 1:The learner will be able to act confidently on curiosity about natural phenomena, and to investigate relationships and solve problems in scientific, technological and environmental contexts.

Assessment Standard 1.2: We know this when the learner conducts investigations and collects data: organises and uses apparatus/equipment or sources to gain and record information

Assessment Standard 1.3: We know this when the learner evaluates data and communicates findings: generalises in terms of relevant aspects and describes how the data support the generalisation.

Learning Outcome 2:The learner will know and be able to interpret and apply scientific, technological and environmental knowledge.

Assessment Standard 2.1: We know this when the learner recalls meaningful information: the minimum requirement is an ability to recall definitions and complex facts.

2.16 To demonstrate the magnetism in the poles of a magnet[16]

2.16.1 NATURAL SCIENCES

2.16.2 Energy transfers and forces

2.16.3 A. Forces

2.16.4 EDUCATOR SECTION

2.16.5 Memorandum

Observation: The iron filings stick to the ends of the magnets.

Conclusion: The poles of the rod magnet have the greatest gravitational force.

2.16.6 LEANER SECTION

2.16.7 Content

2.16.7.1 ACTIVITY: To demonstrate the magnetism in the poles of a magnet [LO 1.2]

For the educator: Place a thick line of iron filings on a clean sheet of paper. Carefully insert a bar magnet into a test tube. Draw the test tube through the line of iron filings.

- Observation:_____

_____

_____

_____

_____

_____

[16]This content is available online at <http://cnx.org/content/m20358/1.1/>.

- Deduction:_____

_____
_____
_____
_____
_____

- The ends of the bar magnet are known as the poles of the magnet. The red end is the north pole (north-seeking pole) and the blue end is the south pole (south-seeking pole).

2.16.7.2 3. Forces between magnets

When magnets are near one another, forces are generated between them. The following experiment will make it possible to find out what these forces are.

2.16.8 Assessment

Learning Outcome 1:The learner will be able to act confidently on curiosity about natural phenomena, and to investigate relationships and solve problems in scientific, technological and environmental contexts.

Assessment Standard 1.2: We know this when the learner conducts investigations and collects data: organises and uses apparatus/equipment or sources to gain and record information;

2.17 To demonstrate the polarity of bar magnets[17]

2.17.1 NATURAL SCIENCES

2.17.2 Energy transfers and forces

2.17.3 EDUCATOR SECTION

2.17.4 Memorandum

(a) **What do you observe?** The paper clip also moves upwards and remains hanging in the air under the magnet.

What happens? The paper clip falls back onto the bench.

(b) **What happens?** The paper clip retains its position in the air.

Conclusion: Magnets are able to attract magnetic materials through non-magnetic materials, but not through magnetic materials.

Explanation: A tin can is made of iron that is covered with a thin layer of tin.

2.17.5 LEANER SECTION

2.17.6 Content

2.17.6.1 ACTIVITY: To demonstrate the polarity of bar magnets [LO 1.2]

Use two bar magnets and six short drinking straws. Bar magnets usually are painted in two colours. One half is red and the other is blue, but some bar magnets are painted silver and red.

Arrange the straws and place the bar magnet on them as indicated in the illustration. Observe what happens.

[17] This content is available online at <http://cnx.org/content/m20359/1.1/>.

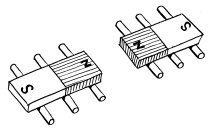


Figure 2.26

Observation:_____
_____
_____
_____
_____
Try to predict what will happen if you arrange the magnets as indicated in the next sketch.

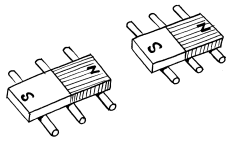


Figure 2.27

Prediction: _____
_____
_____
_____
_____
Observation: _____
_____
_____
_____
_____
Did you predict correctly? _____
Deduction:_____
_____
_____
_____
_____
This is the law of magnetic poles.

2.17.6.2 4. Magnetic force acting through different materials

Let us see whether a magnet is able to exert attraction through a magnetic material and through a non-magnetic material.

2.17.7 Assessment

2.17.8

Learning Outcome 1: The learner will be able to act confidently on curiosity about natural phenomena, and to investigate relationships and solve problems in scientific, technological and environmental contexts.

Assessment Standard 1.2: We know this when the learner conducts investigations and collects data: organises and uses apparatus/equipment or sources to gain and record information;

2.18 To test the magnetic force of a magnet on magnetic as wells as non-magnetic substances[18]

2.18.1 NATURAL SCIENCES

2.18.2 Energy transfers and forces

2.18.3 EDUCATOR SECTION

2.18.4 Memorandum

(a) **What do you observe?** The paper clip also moves upwards and remains hanging in the air under the magnet.

What happens? The paper clip falls back onto the bench.

(b) **What happens?** The paper clip retains its position in the air.

Conclusion: Magnets are able to attract magnetic materials through non-magnetic materials, but not through magnetic materials.

Explanation: A tin can is made of iron that is covered with a thin layer of tin.

2.18.5 LEANER SECTION

2.18.6 Content

2.18.6.1 ACTIVITY 18: To test the magnetic force of a magnet on magnetic as wells as non-magnetic substances [LO 2.3]

(a) Tie one end of a length of sewing thread to a paper clip and use wonder glue / Prestik to secure the other end to your desk. Hold a bar magnet above the paper clip and lift it.

What do you observe? _____

_____

_____

_____

Now place the lid of a tin can between the paper clip and the magnet.

There must be no contact between these objects.

What happens when you do this? _____

_____

_____

_____

(b) Repeat the procedure of 4(a), but insert a sheet of paper between the magnet and the paper clip.

What happens now? _____

_____

_____

_____

[18]This content is available online at <http://cnx.org/content/m20365/1.1/>.

What deduction can you make from this? _____
_____
_____
_____

- Remember that paper is a non-magnetic material and the tin can lid is a magnetic material.
- Try to explain why the tin can lid is magnetic, while tin is not.

_____
_____
_____
_____
_____
_____
_____
_____
_____

2.18.6.2 5. A magnetic field

A magnet is surrounded by a magnetic field. This is the area around a magnet in which it can experience force. The earth must therefore be surrounded by a magnetic field, and this would mean that we are living in a magnetic field! What would happen if there were no magnetic field around the earth?

_____
_____
_____
_____
_____
_____
_____

We will now use iron filings to help us examine the magnetic field of a bar magnet.

2.18.7 Asessment

Learning Outcome 2:The learner will know and be able to interpret and apply scientific, technological and environmental knowledge.

Assessment Standard 2.3: We know this when the learner interprets information by identifying key ideas in text, finding patterns in recorded data, and making inferences from information in various forms (e.g. pictures, diagrams, text).

2.19 To examine the magnetic field of a bar magnet[19]

2.19.1 NATURAL SCIENCES

2.19.2 Energy transfers and forces

2.19.3 EDUCATOR SECTION

2.19.4 Memorandum

Sketch of a rod magnet. The direction of the magnetic field lines must be indicated from north to south.

[19]This content is available online at <http://cnx.org/content/m20371/1.1/>.

2.19.5 LEANER SECTION

2.19.6 Content

2.19.6.1 ACTIVITY 19: To examine the magnetic field of a bar magnet [LO 2.4]

Sketch what you see.

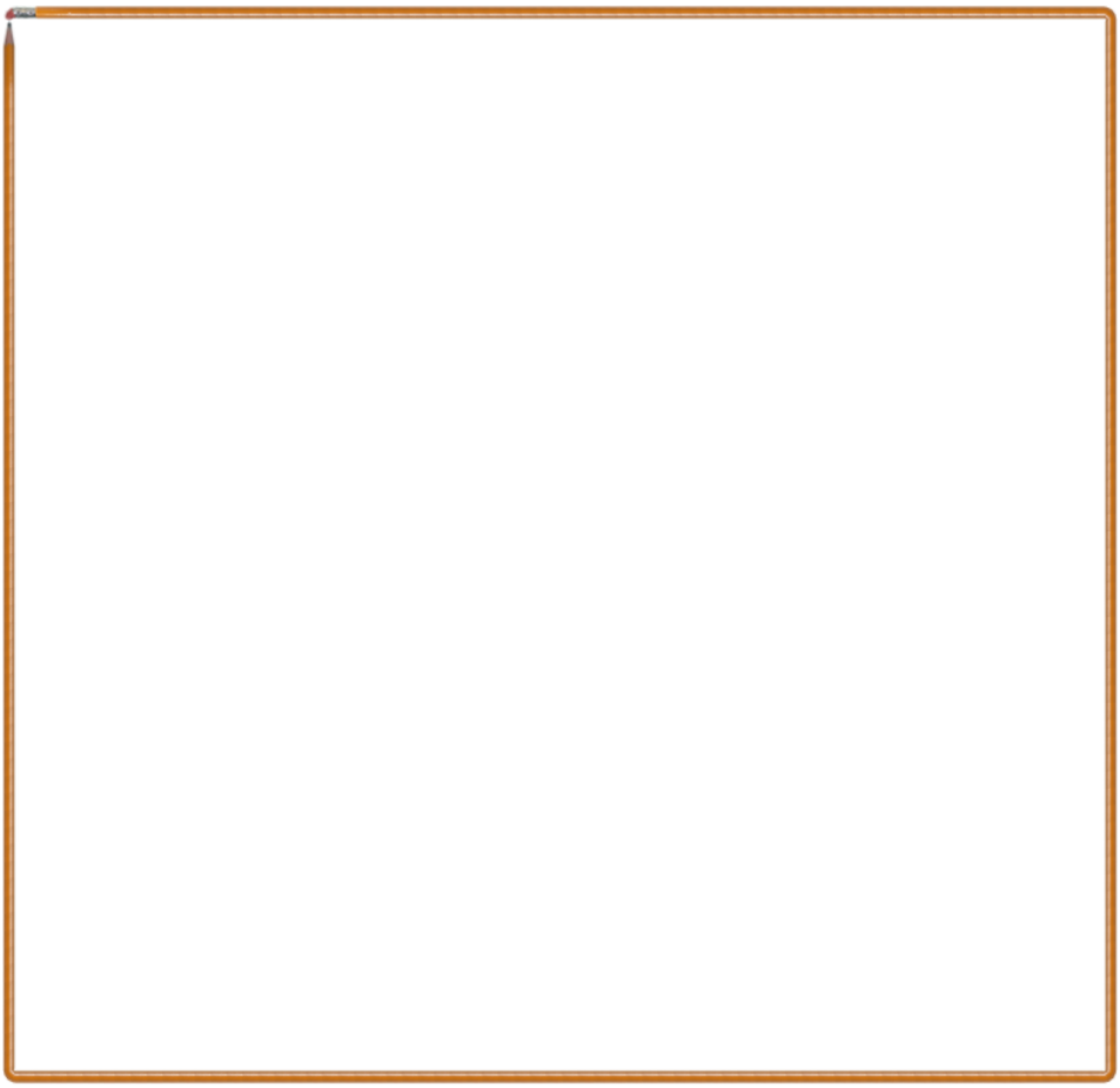


Figure 2.28

Use a compass to determine the direction of the magnetic field and draw arrows to show this on your sketch.

6. Making a magnet

Magnets are made from steel. Steel can be magnetised by using electricity or by stroking it with another magnet.

2.19.7 Assessment

Learning Outcome 2: The learner will know and be able to interpret and apply scientific, technological and environmental knowledge.

Assessment Standard 2.4: We know this when the learner application of knowledge: applies knowledge appropriately by connecting the learnt concept to a variation of the known situation.

2.20 Groupwork: To learn how to make a magnet[20]

2.20.1 NATURAL SCIENCES

2.20.2 Energy transfers and forces

2.20.3 EDUCATOR SECTION

2.20.4 Memorandum

The more the knitting needle is stroked with the magnet, the more paper clips will be attracted by it. Learners can heat, drop or beat the knitting needle in order to destroy its magnetism.

2.20.5 LEANER SECTION

2.20.6 Content

2.20.6.1 ACTIVITY 20: Groupwork: To learn how to make a magnet [LO 2.4]

Each group will need: a bar magnet
a steel knitting needle
Prestik / wonder glue
10 paper clips

1. Use wonder glue to secure the knitting needle on the desk.

2. Slide the magnet along the knitting needle from end to end, making sure that you stroke the knitting needle in the same direction and use the same end of the magnet all the time. (Make a mark on the point of the knitting needle at which you lift the magnet while you are stroking it.)

3. Repeat the stroking movement 10 times and then check to see how many paper clips can be lifted with the needle.

_____

4. Repeat the stroking movement for another 10 times and see how many paper clips can be lifted now.

_____

5. What kind of pole do you have at the end where you have made the mark?_____

(Use the magnet with which you stroked the knitting needle for determining this and remember the law of magnetic poles, bearing in mind that the half of the magnet that is painted red is the north pole.)

6. Write down two things that you could do to destroy the magnetism of the knitting needle.

_____
_____
_____
_____

7. Follow your suggestions in point no. 6 to see if this does happen. YES / NO

[20]This content is available online at <http://cnx.org/content/m20372/1.1/>.

8. Make a magnet of your own at home, but make use of electricity to create an electromagnetic magnet. Your teacher will explain how to do it. Check to see whether your magnet is able to attract magnetic materials when you bring it to class. This will serve as a measure to test the success of your work.

7. **Uses of magnets:**

Magnetic force is used daily to make our lives easier.

2.20.7 Assessment

2.20.8

Learning Outcome 2:The learner will know and be able to interpret and apply scientific, technological and environmental knowledge.

Assessment Standard 2.4: We know this when the learner application of knowledge: applies knowledge appropriately by connecting the learnt concept to a variation of the known situation.

2.21 Groupwork: To describe the usefulness of magnets in everyday life[21]

2.21.1 NATURAL SCIENCES

2.21.2 Energy transfers and forces

2.21.3 EDUCATOR SECTION

2.21.4 Memorandum

(a) Aeroplane hangars / on ships.

(b) It facilitates the task of tightening or loosening screws, seeing that the magnetized screwdriver attracts the screws.

(c) Little force is needed to close the door seeing that it is attracted by magnetism; it is important that a refrigerator should seal tightly.

(d) To remove fine steel splinters from a patient's eye.

(e) Sound waves are attracted.

(f) Remote-controlled toys.

Let us test our knowledge

(a) Repel; attract.

(b) Those that are attracted by a magnet are magnetic, and those that are not attracted by a magnet are non-magnetic.

(c) Both poles are equally powerful.

(d) North pole to south pole.

(e) Expands.

(f) Copper.

(g) Untrue.

(h) South pole.

(i) North pole.

(j) Test whether it can attract magnetic materials.

[21] This content is available online at <http://cnx.org/content/m20375/1.1/>.

2.21.5 LEANER SECTION

2.21.6 Content

2.21.6.1 ACTIVITY 21: Groupwork: To describe the usefulness of magnets in everyday life [LO 2.4]

(a) A magnet that rotates freely is known as a compass. A compass is used to show direction.

Figure 2.29

The needle of a compass always comes to rest with one pole – the north or north-seeking pole of the compass - pointing northwards. The other pole of the needle is the south or south-seeking pole.

List two situations in which the use of compasses is necessary:

_____
_____
_____
_____

(b) Some screwdrivers are magnetised.

What value does this have for the person using it?

_____
_____
_____

(c) Fridges and some cupboards have magnets in the door.

Why are magnets used in doors?

_____
_____
_____

(d) Doctors also use powerful magnets.

Can you work out why they do this?

_____
_____
_____
_____

(e) Telephones and loudspeakers contain magnets.

What is the purpose of having magnets in such instruments and appliances?

_____
_____
_____
_____

(f) Some toys have magnets.

Which toys that you know have magnets and why do they have them?

_____

_____
_____
_____
_____
_____

8. Fun with magnets

(a) Remove a paper clip from a glass full of water without getting your hands wet or emptying the glass.

(b) Try to move magnetic materials without touching them or letting your friends know how you manage it.

9. Something interesting

There are trains that work on the simple principle that opposing poles of magnets affect one another. A magnetic force draws arms below the train towards the tracks and thereby lifts the train so that it can float. Another magnetic field propels the train forwards. The train does not touch the track and there is therefore little friction to cause wear to the brakes or the track. Another example of such levitation (or floating) is that the train can achieve very high speeds.

10. Let's test our knowledge. You may refer to your module to assist you with your answers.

(a) Complete: While two N poles will _____ each other,
a N pole and a S pole will_____. one another.

How will you determine whether a material is magnetic or non-magnetic?

_____
_____

Which of the poles of a magnet is more powerful: the N pole or the S
pole? _____

Complete: The direction of magnetic field lines around a magnet is from
the _____ pole to the _____
pole
of the magnet.

Underline the characteristic that does not relate to magnets:
repelling, attracting, directional; expansion; polarity.

Underline the name(s) of the non-magnetic material(s): copper, steel, iron, cobalt, nickel.

True or false? Magnets can attract materials through other magnetic
materials. _____

Picture one end of a bar magnet being held close to the N pole of the needle of a compass. What will the polarity of that end of the bar magnet be?

_____

Complete: If a steel knitting needle is stroked repeatedly with the south pole of a powerful magnet, the tip of the needle at which the stroking ends will
become a _____
pole

How can you determine whether a steel needle has been magnetised?

_____
_____
_____
_____

Summative (10)

2.21.7 Assesment

2.21.8

Learning Outcome 2:The learner will know and be able to interpret and apply scientific, technological and environmental knowledge.

Assessment Standard 2.4: We know this when the learner application of knowledge: applies knowledge appropriately by connecting the learnt concept to a variation of the known situation.

Chapter 3

Term 3

3.1 To describe the terms matter, atoms, molecules, elements and compounds[1]

3.1.1

3.1.2 NATURAL SCIENCES

3.1.3 Matter, measuring and reaction

3.1.4

3.1.5 EDUCATOR SECTION

3.1.6 Memorandum

Assignment 1:

1. Matter is the building material that everything is made of

2. Natural: steel; diamonds; copper; granite; cotton; iron
Synthetic: plastic; glass; soap; nylon; rubber
Definitions: Atom: the smallest particle all matter is made of
Element: Element: a material that consists of just one type of atom
Molecule: a group of atoms that form a unit that displays the characteristics of the material
Compound: a material that consists of two or more atoms that can be broken up into other materials

3.1.7 LEANER SECTION

3.1.8 Content

Chemistry is a subdivision of the Natural Sciences learning area. It is the science that deals with the composition and characteristics of substances (matter). All of us make use of *Chemistry* every day, because simple things like making a cup of coffee or making popcorn involves chemistry.

3.1.8.1 ACTIVITY: To describe the terms matter, atoms, molecules, elements and compounds [LO 2.2]

1. What is matter?

[1] This content is available online at <http://cnx.org/content/m20441/1.1/>.

Matter is the scientific term for the building materials used in the composition of all things. All objects on earth are made of matter - the book you are reading, the table on which you work and the air you inhale. But it is not *non-living* or *inanimate* things only that are made of matter. All *living things*, like plants or animals, are also made of matter.

Assignment 1:

1. Write your own explanation of what matter is:

_____
_____
_____
_____
_____

2. Although many non-living substances occur *naturally*, they have to be purified or processed before they can be used. Iron, which has to be separated from iron ore, is an example of this, as is oil, which has to be refined to be made useable. Other substances are made by combining and treating different raw materials, e.g. cotton, wood and wool. Materials obtained in this way are referred to as *synthetic materials*.

Classify the following materials as natural or synthetic. Circle the natural substances and underline the synthetic substances.

steel;	plastic;	glass;	diamonds;
copper;	soap;	granite;	nylon;
rubber;	gold;	oxygen;	iron;
salt;	vinegar;	leather;	coffee

Table 3.1

Atoms, molecules, elements and compounds

All matter in the world consists of very small particles. These particles are known as *atoms*; they are the smallest particles from which matter is made and can only be observed with the help of a microscope. A number of atoms are combined to form a *molecule,* just like bricks that are arranged together to form a wall.

An *element* is a substance that consists of one kind of atom only. This means that an element cannot be divided to obtain something else. A *compound* is a substance that consists of two or more kinds of atoms and it can be divided to provide other substances. Some of these substances could be elements. Water is the most common compound that we know. It consists of the elements hydrogen and oxygen.

The difference between elements and compounds can also be represented as the difference between a loaf of bread and its ingredients. The “elements” are the ingredients of the bread, namely water, yeast, sugar, flour, salt and butter. The “compound” is the loaf that is baked when these ingredients have been mixed together.

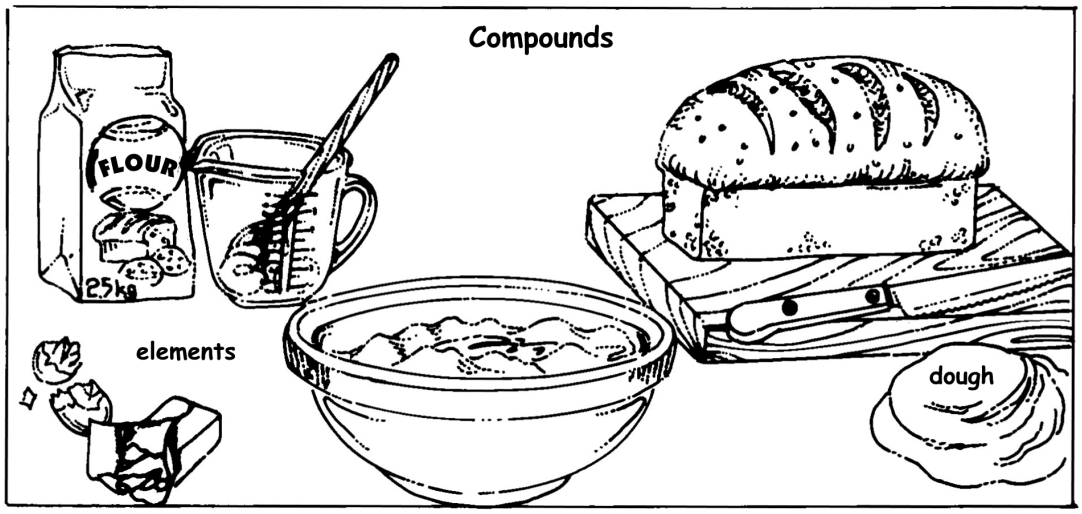


Figure 3.1

Explain the following terms in your own words:
Atoms: _____
_____
_____
_____
Element: _____
_____
_____
_____
Molecule: _____
_____
_____
_____
Compound: _____
_____
_____
_____

3.1.9 Assessment

3.1.10

Learning Outcome 2:The learner will know and be able to interpret and apply scientific, technological and environmental knowledge.

Assessment Standard 2.2: We know this when the learner categorises information.

3.2 To investigate the breaking up of compounds into simpler substances[2]

3.2.1 NATURAL SCIENCES

3.2.2 Matter, measuring and reactions

3.2.3 EDUCATOR SECTION

3.2.4 Memorandum

Groupwork:

Observation: The glowing wooden splinter catches fire because oxygen has been released.

Conclusion: Mercury oxide is a compound that decomposed as a result of heating. It broke up into oxygen (a gas) and mercury (a metal).

Mercury Oxide = mercury + oxygen

3.2.5 LEANER SECTION

3.2.6 Content

3.2.6.1 ACTIVITY: To investigate the breaking up of compounds into simpler substances [LO 1.2, LO 1.3]

Group work:

Do the following experiment in your groups to determine whether mercuric oxide is a compound consisting of elements. Follow the different steps exactly:

- Pour a small amount of mercuric oxide, which is red in colour, into a test tube.
- Heat it over a Bunsen burner or the flame of a candle in a well-ventilated room.
- Wait for the mercuric oxide to turn black and for small droplets of mercury to collect on the cooler side of the test tube.
- Insert a glowing splinter of wood into the top of the test tube. Observe the reaction that occurs.

[2] This content is available online at <http://cnx.org/content/m20442/1.1/>.

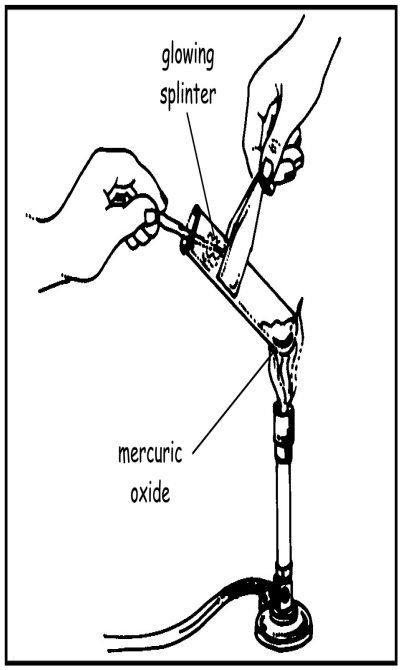


Figure 3.2

Observation: _____
_____
_____
Deduction: _____
_____
_____

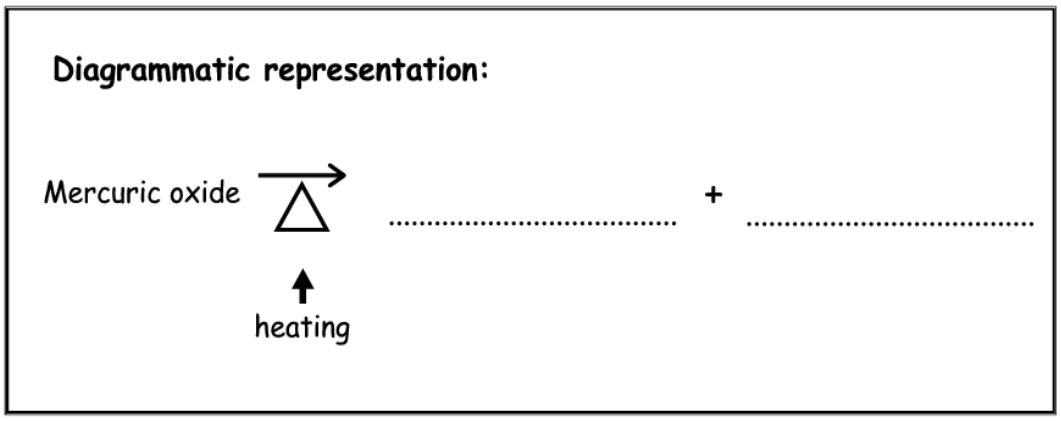


Figure 3.3

Assessment

MARK	LEVEL	COOPERATIVELEARNINGSKILLS	VALUES AND ATTITUDES	CONTENT
1-34%	1	Each learner learns individually. Participation in the group is destructive, e.g. domineering.	No respect for others. Destructive interpersonal relationships (actively negative).	Not able to come to meaningful observations and deductions.
35-39 %	2	Does not contribute to the group and forms no meaningful part of it.	Not respectful towards others, but this does not affect interpersonal relationships (negatively passive).	Observations and deductions fairly sound.

continued on next page

40-69%	3	Acknowledged as a member of the group. Sensitive to the needs of others.	Shows consideration for others and understanding of different points of view, but this has no effect on interpersonal relationships (positively passive).	Observations and deductions sound.
70-100%	4	Creates opportunities for contributions by other members of the group. Always contributes positively to the group task.	Shows consideration for others and understanding of different points of view. Influences interpersonal relationships in a positive way (positively active).	Observations and deductions excellent.

Table 3.2

3.2.7 Assessment

Learning Outcome 1: The learner will be able to act confidently on curiosity about natural phenomena, and to investigate relationships and solve problems in scientific, technological and environmental contexts.

Assessment Standard 1.2: We know this when the learner conducts investigations and collects data: organises and uses apparatus/equipment or sources to gain and record information;

Assessment Standard 1.3: We know this when the learner evaluates data and communicates findings: generalises in terms of relevant aspects and describes how the data support the generalisation.

3.3 To investigate and discuss physical and chemical changes in substances[3]

3.3.1 NATURAL SCIENCES

3.3.2 Matter, measuring and reactions

3.3.3 EDUCATOR SECTION

3.3.4 Memorandum

Examples of physical change: a pan that is heated; tea that cools down

Examples of chemical change: burning match; toasting bread

Marshmallow

- Yes, it tastes slightly different after being toasted
- Yes, it became black and powdery
- **Chemical change.** It is permanent - the chemical reaction changed the sugar to carbon.

Leaner Section

[3]This content is available online at <http://cnx.org/content/m20443/1.1/>.

3.3.5 Content

3.3.5.1 ACTIVITY: To investigate and discuss physical and chemical changes in substances [LO 2.3]

People make use of different natural substances and change them into something else. To achieve this change, substances are mixed with other substances, heated, separated, dissolved or treated with electricity. Some changes are not permanent, while other changes cannot be reversed. We also distinguish between physical and chemical changes.

Physical Change

When crystallised honey is heated in a pot it becomes fluid again. But when it cools down and is exposed to air, it will crystallise once more. No new substances are formed and the properties of the honey remain exactly what they were. The change is a physical change. In the previous experiment, the orange/red mercuric oxide became black when it cooled down (physical change).

Chemical change

When you pour pancake batter into warm oil, something happens: the appearance of the batter changes. It is not runny any more, but stiff. The change that occurs is permanent. A change that is permanent and results in something new is a chemical change. The properties of the new substance differ from those of the original substances. The mercuric oxide also experienced a chemical change when it was decompounded into mercury and oxygen.

Name two further examples of physical and two examples of chemical change:

_____
_____
_____
_____

Try the following:

Bring some marshmallows to school. Push them onto the prongs of a fork and heat them over a flame. Answer the questions that follow.

- Taste a marshmallow (when it has cooled down). Has the taste changed?
- Has the appearance changed? Describe what you observe.
- Did this involve a physical or a chemical change? Motivate your findings.

_____
_____
_____
_____

Figure 3.4

3.3.6

3.3.7 Assessment

3.3.8

Learning Outcome 2: The learner will know and be able to interpret and apply scientific, technological and environmental knowledge.

Assessment Standard 2.3: We know this when the learner interprets information by identifying key ideas in text, finding patterns in recorded data, and making inferences from information in various forms (e.g. pictures, diagrams, text).

3.4 (Untitled)ACTIVITY: To describe the composition of substances in terms of chemical symbols and formulas[4]

3.4.1 NATURAL SCIENCES

3.4.2 Matter, measuring and reactions

3.4.3 EDUCATOR SECTION

3.4.4 Memorandum

Water:

- H_2O
- Hydrogen and oxygen
- The elements oxygen and hydrogen joined. This formed a new substance, namely water, that consists of two types of atoms. The atoms joined to form a water molecule.
- Yes, the elements are combined in a fixed relation to form a new substance with new characteristics.

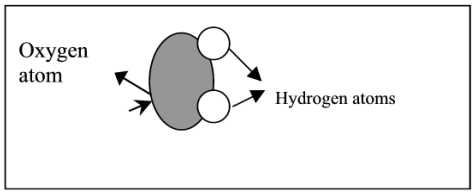


Figure 3.5

Assignment 2:

1.

- 500 oxygen atoms
- 1 000 oxygen atoms

2. Combination

[4]This content is available online at <http://cnx.org/content/m20447/1.1/>.

FORMULA	COMBINATION
O_2	Oxygen molecule: two oxygen atoms
NaCl	Sodium chloride (table salt): one atom sodium and one atom chloride
N_2O_5	Sodium oxide molecule: two sodium atoms combine with five oxygen atoms
Fe_2O_3	Iron oxide: two iron atoms combine with three oxygen atoms
$MgCl_2$	Magnesium chloride: one magnesium atom combines with two chloride atoms
CO	Carbon monoxide: one carbon atom binds to one oxygen atom

Table 3.3

3.4.5 LEANER SECTION

3.4.6 Content

3.4.6.1 ACTIVITY: To describe the composition of substances in terms of chemical symbols and formulas [LO 2.3]

When we know the physical and chemical properties of a substance we can use our knowledge to create another substance. Water, a compound, is the best solvent because many substances can dissolve in water. We can use the compound water to obtain gases like hydrogen and oxygen. We can also produce water by mixing these gases.

We make use of chemical symbols to identify elements and use chemical formulas to identify compounds. Here are some chemical symbols:

- Ag (symbol) is used for silver
- Fe is used for iron
- Pb is used for lead
- Au is used for gold

Try to illustrate the composition of a water molecule:

- Write the chemical formula for water.

_____

- Name the two elements that form water?

_____ and _____

- What had to happen to these elements to form water?

Use the words: elements, atoms and molecules in your explanation.

_____
_____

- Would this compound depend on a fixed ratio or could it change at random? Motivate your answer.

_____
_____
_____

- Provide a graphic representation of the atomic composition of water:

3.4.6.2 ASSIGNMENT 2

Now try to analyse the chemical formula for carbon dioxide (carbonic acid gas):

Carbon dioxide is a compound of two kinds of atoms. The chemical formula is:

CO2

CO 2

This formula signifies that one atom of carbon combines with two atoms of oxygen to form carbon dioxide. We can therefore say that the ratio of carbon atoms to oxygen atoms in carbon dioxide molecules is 1:2.

1. How many atoms of oxygen will have to be present for:

- 250 carbon atoms?_____
- 500 carbon atoms?_____

2. Work out the combinations that are present in the following formulas:

FORMULA	COMBINATION
O_2	_____
NaCl	_____
N_2O_5	_____
Fe_2O_3	_____
$MgCl_2$	_____
CO	_____

Table 3.4

3.4.7 Assessment

Learning Outcome 2: The learner will know and be able to interpret and apply scientific, technological and environmental knowledge.

Assessment Standard 2.3: We know this when the learner interprets information by identifying key ideas in text, finding patterns in recorded data, and making inferences from information in various forms (e.g. pictures, diagrams, text).

3.5 To investigate plastic as an example of a synthetic or man-made substance[5]

3.5.1

3.5.2 NATURAL SCIENCES

3.5.3 Matter, measuring and reactions

3.5.4 EDUCATOR SECTION

3.5.5 Memorandum

- Organic: living; non-organic: non-living
- Observation: The vinegar reacted with the milk to form a "new" substance with "new" properties

[5]This content is available online at <http://cnx.org/content/m20448/1.1/>.

- Conclusion: The special characteristics of milk and vinegar were used to produce a new synthetic material
- Uses of "new" substance: As plug to seal something; protection; decoration, etc.
- As in given illustration, but with the containers used and the heat source (purpose: to practise the learner's ability to represent his/her observation in a sketch).

3.5.6 LEANER SECTION

3.5.7 Content

3.5.7.1 Activity: To investigate plastic as an example of a synthetic or man-made substance [LO 1.2, LO 1.3]

Plastic is a man-made substance. It was developed because of its special properties and because it is cheaper to manufacture than to find natural materials. Plastic, for instance, is light and waterproof. It is very useful as a packaging material and as protection for other materials.

3.5.7.1.1 EXPERIMENT: MAKING YOUR OWN PLASTIC

Although most plastics are manufactured from petroleum, a similar plastic can be produced from milk. Milk contains carbon and can therefore be classified as an organic substance.

- Consult a dictionary to find the meaning of "organic".

_____

REQUIREMENTS:
20 ml vinegar;
a cooking pot;
200 ml full-cream milk
METHOD:

- Pour the milk into the pot and slowly heat it to boiling point.
- Add 20 ml vinegar to the milk.
- Keep the pot on the heat and stir the mixture continuously until it becomes rubbery.
- Remove the pot from the heat and allow the mixture to cool down properly.
- Use water to rinse the mixture.

OBSERVATION:

_____
_____
_____
_____

DEDUCTION:

_____
_____
_____
_____

- Possible uses for the "new" material:

_____
_____

- Refer to the verbal description of the experiment and illustrate the experiment by means of a sketch or a diagrammatic representation of the process.

ASSESSMENT

LO	MARKS	LEVEL	KEY TO LEVEL
1	Less than 5	1	The sketch/representation is meaningless, presented without observation or deduction
	5 – 7(25% – 39%)	2	A basic representation reflecting little observation and no deduction
	8 – 13(40% – 69%)	3	A satisfactory representation /sketch showing basic observation, but hardly any deduction
	14 – 20(70% – 100%)	4	A complete representation with captions showing the experiment and reflecting both observation and deduction

Table 3.5

3.5.8 Assessment

3.5.9

Learning Outcome 1: The learner will be able to act confidently on curiosity about natural phenomena, and to investigate relationships and solve problems in scientific, technological and environmental contexts.

Assessment Standard 1.2: We know this when the learner conducts investigations and collects data: organises and uses apparatus/equipment or sources to gain and record information;

Assessment Standard 1.3: We know this when the learner evaluates data and communicates findings: generalises in terms of relevant aspects and describes how the data support the generalisation.

3.6 To explain the three basic forms of matter in terms of particle theory[6]

3.6.1 NATURAL SCIENCES

3.6.2 Matter, measuring and reactions

3.6.3 EDUCATOR SECTION

3.6.4 Memorandum

Assignment 3:

Basic forms of matter

[6] This content is available online at <http://cnx.org/content/m20524/1.1/>.

SOLIDS	LIQUIDS	GASSES
Iron	Water	Carbon dioxide
Wood	Tea	Oxygen
Plastic	Wine	Nitrogen
Steel	Milk	Carbon monoxide
Copper	Soft drink	Sodium
Paper	Brandy	Iron oxide
Coal	Petrol	Ammonia
Gold	Oil	Methane
Cotton	Handy Andy	Helium
Wool	Honey	
Cheese	Yoghurt	

Table 3.6

3.6.5 LEANER SECTION

3.6.6 Content

3.6.6.1 Activity: To explain the three basic forms of matter in terms of particle theory [LO 2.2]

- SOLID SUBSTANCES
- LIQUIDS
- GASES

The particles in a solid substance remain in place and move very little. They vibrate in a fixed position. This is why solids have a fixed shape and volume. The particles form a regular pattern.

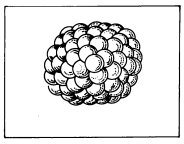


Figure 3.6

In liquids, the particles are able to move freely, but they cannot go far from one another. They do not have a fixed pattern and can therefore take the form of the container in which they are. As the particles are unable to move far from one another, the volume cannot really change.

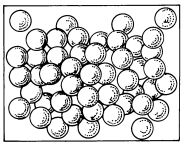


Figure 3.7

The particles of a gas can more or less move to any place. These particles are also much further apart than the particles in a liquid or a solid substance.

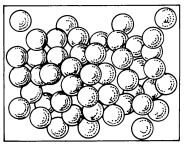


Figure 3.8

ASSIGNMENT 3

See whether you are able to complete the following columns by listing examples of substances that represent the three forms of matter.

Solid substances	Liquid substances	Gases
Iron	Water	Carbon dioxide

continued on next page

Table 3.7

3.6.7 Assessment

Learning Outcome 2: The learner will know and be able to interpret and apply scientific, technological and environmental knowledge.

Assessment Standard 2.2: We know this when the learner categorises information.

3.7 To explain the three basic forms of matter in terms of particle theory[7]

3.7.1 NATURAL SCIENCES

3.7.2 Matter, measuring and reactions

3.7.3 EDUCATOR SECTION

3.7.4 Memorandum

Assignment 3:

3.7.5 Basic forms of matter

SOLIDS	LIQUIDS	GASSES
Iron	Water	Carbon dioxide
Wood	Tea	Oxygen
Plastic	Wine	Nitrogen
Steel	Milk	Carbon monoxide
Copper	Soft drink	Sodium
Paper	Brandy	Iron oxide
Coal	Petrol	Ammonia
Gold	Oil	Methane
Cotton	Handy Andy	Helium
Wool	Honey	
Cheese	Yoghurt	

Table 3.8

[7] This content is available online at <http://cnx.org/content/m20456/1.1/>.

3.7.5.1 LEANER SECTION

3.7.5.2 Content

3.7.5.3 Activity: To explain the three basic forms of matter in terms of particle theory [LO 2.2]

- SOLID SUBSTANCES
- LIQUIDS
- GASES

The particles in a solid substance remain in place and move very little. They vibrate in a fixed position. This is why solids have a fixed shape and volume. The particles form a regular pattern.

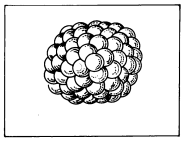


Figure 3.9

In liquids, the particles are able to move freely, but they cannot go far from one another. They do not have a fixed pattern and can therefore take the form of the container in which they are. As the particles are unable to move far from one another, the volume cannot really change.

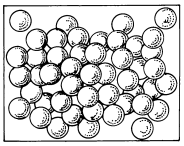


Figure 3.10

The particles of a gas can more or less move to any place. These particles are also much further apart than the particles in a liquid or a solid substance.

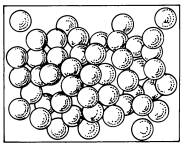


Figure 3.11

3.7.6 ASSIGNMENT 3

See whether you are able to complete the following columns by listing examples of substances that represent the three forms of matter.

Solid substances	Liquid substances	Gases
• Iron	• Water	• Carbon dioxide

Table 3.9

3.7.6.1 Assessment

3.7.6.2

Learning Outcome 2: The learner will know and be able to interpret and apply scientific, technological and environmental knowledge.

Assessment Standard 2.2: We know this when the learner categorises information.

3.8 To explain that all matter occupies space and has volume and mass[8]

3.8.1 NATURAL SCIENCES

3.8.2 Matter, measuring and reactions

3.8.3 EDUCATOR SECTION

3.8.4 Memorandum

Assignment 4:

1. No
2. No

[8] This content is available online at <http://cnx.org/content/m20459/1.1/>.

- It will rise, because the little fish takes up the space of the water and the water has to take up some other space.
- **Experiment:** Accept any meaningful planning, for instance bicycle pump that cannot be pushed in completely if the opening is closed.

Mass as opposed to weight: Mass gives an indication of the amount of matter, while weight indicates how strongly the earth attracts an object. Mass remains unchanged, while weight is influenced by the location on earth - e.g. high up in the atmosphere it is less.

3.8.5 LEANER SECTION

3.8.6 Content

3.8.6.1 Activity: To explain that all matter occupies space and has volume and mass [LO 1.1, LO 2.3]

Assignment 4

Matter occupies space

Study the following sketches and answer the questions that follow:

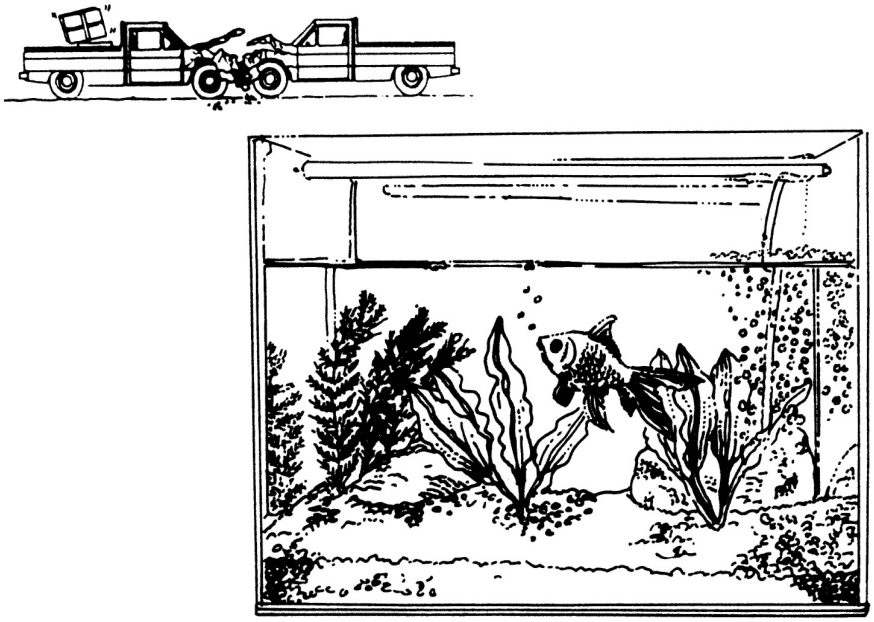


Figure 3.12

1. Is it possible for two objects to occupy the same space simultaneously? (Yes / No)

_____

2. Examine the sketch of a fish in an aquarium:

_____

- Do the fish and the water occupy the same space?

_____

- What would happen to the water level if the fish were to produce young?

_____
_____
_____
_____

When we examine the above sketches, it is obvious that two objects cannot occupy the same space at the same time. The reason for this is quite simple: Each object requires its own space. Another deduction that we could make is that matter that is displaced by some other substance occupies other available space.

Matter has volume and mass

If you drink all the cold drink in a cold drink can, the can is not left empty. The original contents (cold drink) have been replaced with air! The same space is therefore occupied by another form of matter! Sometimes we speak of the contents of the tin, meaning the matter inside the tin. The space inside the tin that is occupied by matter (cold drink or air, in this instance) is referred to as **volume**. To some extent, therefore, volume and content are synonymous.

Plan an experiment to prove that air occupies space.

_____
_____
_____
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Mass is defined as:

"a physical quantity expressing the amount of matter in a body"and is measured in kilogram.

If I therefore say that I weigh 55 kg, I mean that the amount of matter comprising my body comes to 55 kg.

The mass of an object therefore gives an indication of the amount of matter that an object contains.

The definition of **weight** is:

" the vertical force experienced by a mass as the result of gravitation."

It is important to know that all forms of matter (solid substances, liquids and gases) have mass.

Explain the difference between mass and weight in your own words.

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

3.8.7 Assessment

Learning Outcome 1: The learner will be able to act confidently on curiosity about natural phenomena, and to investigate relationships and solve problems in scientific, technological and environmental contexts.

Assessment Standard 1.1: We know this when the learner plans investigations: plans simple tests and comparisons and considers how to conduct these properly

Learning Outcome 2: The learner will know and be able to interpret and apply scientific, technological and environmental knowledge.

Assessment Standard 2.3: We know this when the learner interprets information by identifying key ideas in text, finding patterns in recorded data, and making inferences from information in various forms (e.g. pictures, diagrams, text).

3.9 To use units of measurement and explaining why it is important to be able to measure[9]

3.9.1 NATURAL SCIENCES

3.9.2 Matter, measuring and reactions

3.9.3 EDUCATOR SECTION

3.9.4 Memorandum

Assignment 4:

1.

- km
- m^3
- mm
- g en mg
- kl of m^3
- m^2
- m en cm
- ton
- kl of cm^3

[9] This content is available online at <http://cnx.org/content/m20469/1.1/>.

- light years (the distance light travels in one year)

- Examples to explain the importance of measurement: any three good examples, e.g.
- the amount of medicine someone has to drink
- how much cement and sand should be mixed for building
- to measure achievements in athletics (high jump, long jump, sprints, etc.)

3.9.5 LEANER SECTION

3.9.6 Content

3.9.6.1 Activity: To use units of measurement and explaining why it is important to be able to measure [LO 2.4]

Before I am able to determine my expenses with regard to fuel for a planned journey, I need to know the distance that I will be travelling. If I want to tile the kitchen floor, I need to calculate the size of the floor (surface). When we want to work out how much milk a baby of a particular age and mass should get, we need to be able to measure the volume (contents) of a bottle, etc. The metric system of measurement (the *Système International d'Unités*, or SI) is used in most parts of the world. The most important units that we have to deal with according to the SI system of measurements are represented in the following table:

	LARGE	MEDIUM	SMALL
Length1 km = 1 000 m1 m = 1 000 mm	kilometre (km)	meter (m)centimetre (cm)	millimetre (mm)
Surface1 cm^2 = 100 $mm^2$1 m^2 = 10 000 cm^2	square meter (m^2)	square centimetre (cm^2)	square millimetre (mm^2)
Content1 kℓ = 1 000 ℓ1 l = 1 000 ml	kiloliter (kℓ)cubic meter (m^3)	litre (ℓ)	cubic centimetre (cm^3)millilitre (mℓ)
Mass1 kg = 1 000 g1 g = 1 000 mg	kilogram (kg)	gram (g)	milligram (mg)

Table 3.10

1. Give the units of measurement that you would use to measure the following?

- the distance that a space shuttle travels around the earth.
- the amount of concrete required for the foundations of a house
- the circumference of roller skate wheels.
- the mass of a locust.

- ❁

Figure 3.13

the capacity of a swimming pool.
- the size (surface) of a tennis court.
- the length of our educator.
- the mass of a truck.

- the capacity of a hot water cylinder.
- the distance from the earth to the nearest star.

2. Name three further examples to show the importance of being able to measure.

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

3.9.7

3.9.8 Assessment

3.9.9

Learning Outcome 2: The learner will know and be able to interpret and apply scientific, technological and environmental knowledge.

Assessment Standard 2.4: We know this when the learner application of knowledge: applies knowledge appropriately by connecting the learnt concept to a variation of the known situation.

3.10 To identify different instruments for measuring[10]

3.10.1 NATURAL SCIENCES

3.10.2

3.10.3 Matter, measuring and reactions

3.10.4

3.10.5 EDUCATOR SECTION

3.10.6

3.10.7 Memorandum

3.10.8

Assignment 5:

a. measuring rod
b. ruler
c. pipette
d. burette

[10] This content is available online at <http://cnx.org/content/m20471/1.1/>.

e. gas sprayer
f. tape measure
g. measuring cylinder
h. digital mass meter
i. balance scale
j. scale
k. callipers

l. weights

3.10.9

3.10.10

3.10.11 LEANER SECTION

3.10.12 Content

3.10.12.1 Activity: To identify different instruments for measuring [LO 2.3]

It is very important to be able to measure accurately. Long ago, people determined their mass with the help of stones. A stone of a particular mass was taken as the standard unit. If a person's mass was equal to eight such stones, for instance, the mass was given as eight stone. Since that time, technology has advanced and extremely accurate instruments have been developed for measuring.

The following is a list of some instruments that are very useful:

burette; gas sprayer, measuring cylinder, balance; callipers, measuring rod, digital mass meter, pipette, ruler, tape measure

ASSIGNMENT 5

Try to provide the correct names for the measuring instruments in the following illustrations:

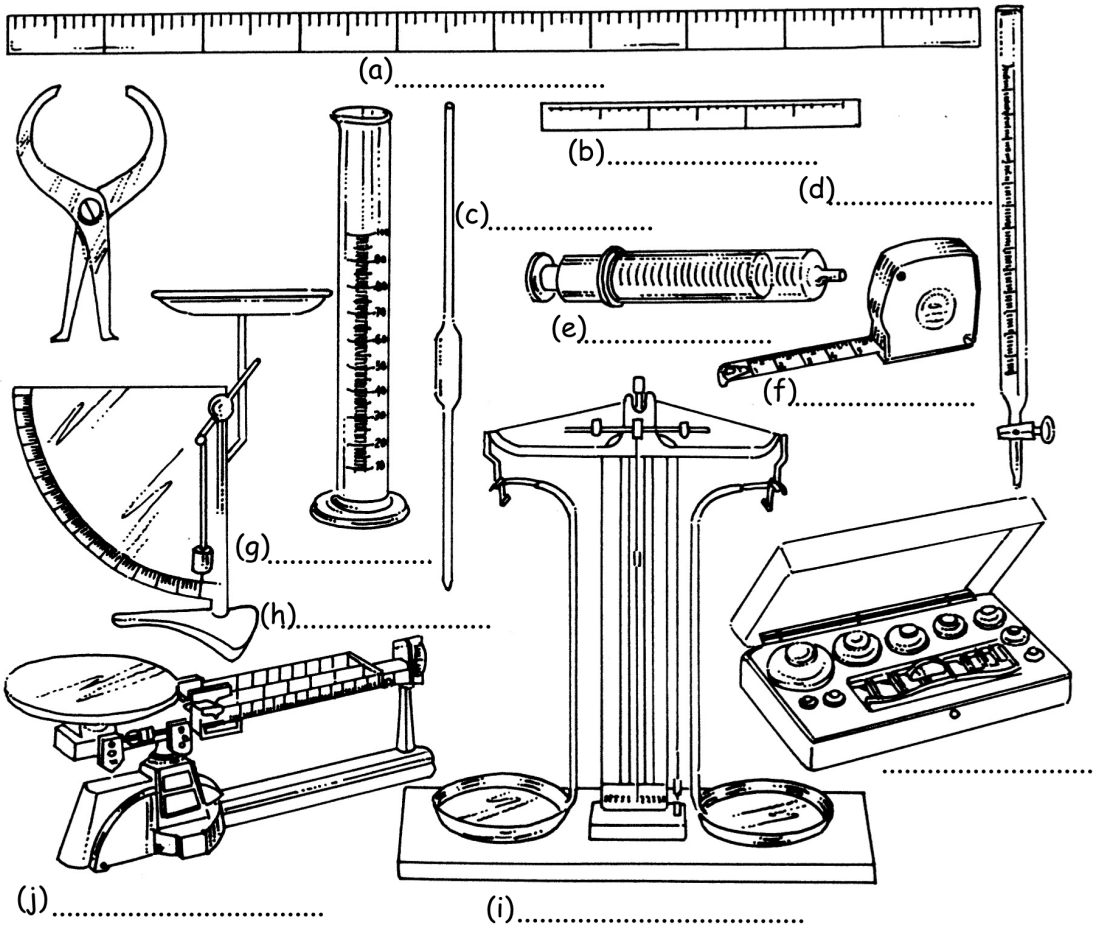

Figure 3.14

10	=		%

Table 3.11

3.10.13 Assessment

3.10.14

Learning Outcome 2: The learner will know and be able to interpret and apply scientific, technological and environmental knowledge.

Assessment Standard 2.3: We know this when the learner interprets information by identifying key ideas in text, finding patterns in recorded data, and making inferences from information in various forms (e.g. pictures, diagrams, text).

3.11 To measure accurately[11]

3.11.1 NATURAL SCIENCES

3.11.2

3.11.3 Matter, measuring and reactions

3.11.4

3.11.5 EDUCATOR SECTION

3.11.6

3.11.7 Memorandum

With the first reading an error of parallax is made. Sketch (b) is therefore accurate. Accept learner's wording, e.g. the scale has to be close to the place of measurement, etc.

3.11.8

3.11.9 LEANER SECTION

3.11.10 Content

3.11.10.1 ACTIVITY: To measure accurately [LO 1.2]

- Which of the following illustrations shows a correct measuring technique?

[11] This content is available online at <http://cnx.org/content/m20473/1.1/>.

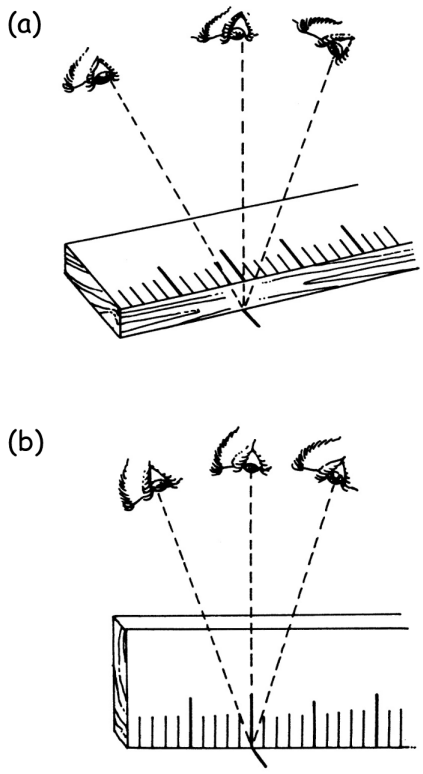

Figure 3.15

Explain:

When your eye is not in line with the scale divisions of a measuring instrument, an error of parallax occurs.

3.11.11 Assessment

Learning Outcome 1: The learner will be able to act confidently on curiosity about natural phenomena, and to investigate relationships and solve problems in scientific, technological and environmental contexts.

Assessment Standard 1.2: We know this when the learner conducts investigations and collects data: organises and uses apparatus/equipment or sources to gain and record information.

3.12 To give an overview of the solar system[12]

3.12.1 NATURAL SCIENCES

3.12.2 Matter, measuring and reactions

3.12.3 EDUCATOR SECTION

3.12.4 Memorandum

Assignment 6:

OBJECT	INSTRUMENT	ESTIMATE	READING
PANE	Yardstick	49 cm	44 cm
DESK	Yardstick	1 m	1,05 m
DOOR	Tape measure	2 m	1,98 m
SHARPENER	Ruler	2 cm	2 cm
FLOOR (CLASSROOM)	Tape measure	9 m	9 m
TENNIS COURT	Tape measure	30 m	18 m
RUGBY FIELD	Tape measure	160 m	143 m

Table 3.12

3.12.5 LEANER SECTION

3.12.6 Content

3.12.7 ACTIVITY: To measure length and breadth [LO 1.2]

ASSIGNMENT 6

Do the following measuring exercise to determine the appropriate measuring instrument.

- First try to estimate (guess).
- Compare your estimate with the actual reading.
- Estimate and then measure the longest sides of the following objects:

[12] This content is available online at <http://cnx.org/content/m20526/1.1/>.

Object	Instrument	Estimation	Reading
Window pane			
Desk			
Door			
Sharpener			
Floor (classroom)			
Tennis court			
Rugby field			

Table 3.13

3.12.7.1 Assesment

Learning Outcome 1: The learner will be able to act confidently on curiosity about natural phenomena, and to investigate relationships and solve problems in scientific, technological and environmental contexts.

Assessment Standard 1.2: We know this when the learner conducts investigations and collects data: organises and uses apparatus/equipment or sources to gain and record information.

3.13 To measure the diameter and circumference of a round object[13]

3.13.1 NATURAL SCIENCES

3.13.2

3.13.3 Matter, measuring and reactions

3.13.4

3.13.5 EDUCATOR SECTION

3.13.6

Memorandum

- The inside diameter is the diameter of the cylinder on the inside. So that one can determine how much contents it can take, for instance.
- The outside diameter is the diameter of the cylinder on the outside. So that one can determine how much space it will occupy.
- Circumference of the can's curved surface: Take thread and wrap it around the can. Place the thread on a ruler and measure its length.
- The circumference is 20,5 cm.
- Nail: 5 cm (estimate); 4 cm (reading)
- Measuring-cylinder: 6 cm (estimate); 5,5 cm (reading)

[13] This content is available online at <http://cnx.org/content/m20474/1.1/>.

3.13.7 LEANER SECTION

3.13.8 Content

3.13.8.1 Activity: To measure the diameter and circumference of a round object [LO 1.2]

Figure 3.16

Consult the following illustration to define the terms "internal diameter" and "external diameter":
The curved surface of the cylinder is known as the convex surface of the cylinder.

- Think of a strategy for measuring the circumference of the convex surface of a cylinder. Use a 340 ml cold drink can as your example.

This is how we measure the convex surface of the tin:
We first ...

_____
_____
_____
_____
_____
_____
_____
_____
_____

- Measure the diameters of the following objects:

Object	Estimation	Reading
Nail (external diameter)	_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _	_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _
Measuring cylinder (internal diameter)	_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _	_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

Table 3.14

3.13.9 Assessment

Learning Outcome 1: The learner will be able to act confidently on curiosity about natural phenomena, and to investigate relationships and solve problems in scientific, technological and environmental contexts.

Assessment Standard 1.2: We know this when the learner conducts investigations and collects data: organises and uses apparatus/equipment or sources to gain and record information.

3.14 To determine surface measurements by means of measuring and calculation[14]

3.14.1 NATURAL SCIENCES

3.14.2

3.14.3 Matter, measuring and reactions

3.14.4

3.14.5 EDUCATOR SECTION

3.14.6

Memorandum

1. My method:
Area = l × b
= 6 cm × 10 cm
= 60 cm^2
2. A = ℓ × b
Area = length multiplied by width
One also uses this formula to determine the area of a rectangle.
3. 25 cm^2

3.14.7

3.14.8 LEANER SECTION

3.14.9 Content

3.14.9.1 Activity: To determine surface measurements by means of measuring and calculation [LO 1.2]

You have probably heard people referring to the size of a house as equal to 150 square meters (150 m^2). Do you know what is meant when people speak of square metres?

[14] This content is available online at <http://cnx.org/content/m20479/1.1/>.

Examine the sketch:Each square of the grid represents one square metre. A square metre is a four-sided plane geometric figure having four equal sides of 1 metre in length.When we say that the surface of fig. X is 100 m^2, we mean that we can fit one hundred single m^2 into it. One could count the number of squares in the grid, or block, to find out what the size of the surface is, but there is a quicker method for finding the answer.If the length of each side of the larger surface is 10 m, you could calculate the number of blocks (square metres) that can fit into the larger surface area (100) by multiplying the length of the one side (10 m) by the length of the other side (10 m x 10 m = 100 square metres).

$1m^2$	$1m^2$	$1m^2$	$1m^2$	$1m^2$	$1m^2$	$1m^2$	$1m^2$	$1m^2$	$1m^2$
$1m^2$									
$1m^2$									
$1m^2$									
$1m^2$									
$1m^2$									
$1m^2$									
$1m^2$									
$1m^2$									
$1m^2$									

Table 3.15

Fig. X

1. How would you determine the surface area of the following rectangle?
(Each block is 1 cm^2)
The length of this rectangle is 100 mm and the breadth is 60 mm.

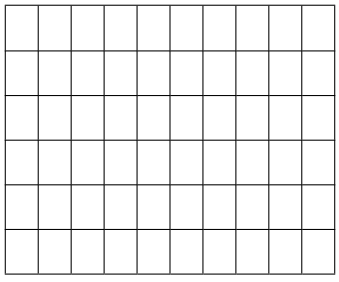

Table 3.16

My method:

_____
_____
_____
_____
_____
_____
(5)

2. What is the meaning of the following formula: A = ℓ b?

_____

_____
_____
_____
_____
_____

3. Apply the following formula to determine the surface area of the given triangle:

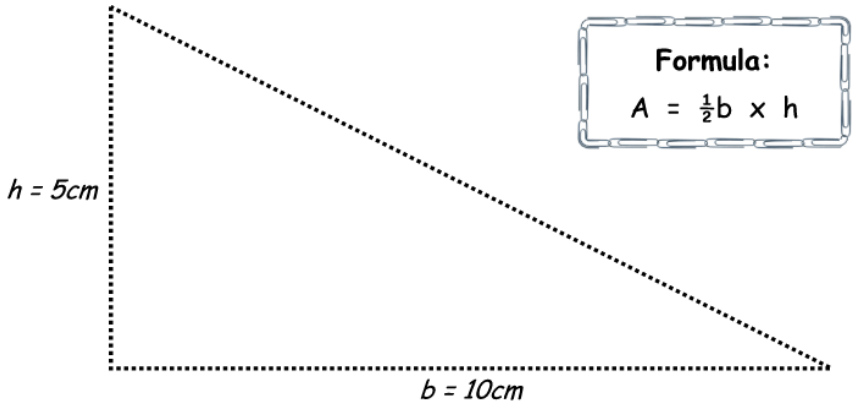

Figure 3.17

b represents the length of the base
h represents the height of the perpendicular line

- My answer (estimated):_____
- My answer (calculated according to the given formula):_____

(2)

3.14.10 Assessment

Learning Outcome 1: The learner will be able to act confidently on curiosity about natural phenomena, and to investigate relationships and solve problems in scientific, technological and environmental contexts.

Assessment Standard 1.2: We know this when the learner conducts investigations and collects data: organises and uses apparatus/equipment or sources to gain and record information.

3.15 To measure the volume of liquid substances[15]

3.15.1 NATURAL SCIENCES

3.15.2

3.15.3 Matter, measuring and reactions

3.15.4

3.15.5 EDUCATOR SECTION

3.15.6 Memorandum

1. Answers may vary from one individual to another:

CONTAINER	ESTIMATED VOLUME	CORRECT VOLUME
Coffee mug	250 mℓ	270 mℓ
Kettle	1 litre	1,704 litre
Tea pot	400 mℓ	592 mℓ

Table 3.17

- Meniscus: This is the curvature of the surface of a liquid due to the liquid's clinging to the sides of the container, to form an upside-down bow.

Assignment 7:

You sip up the liquid and put your finger on the top end as quickly as possible. Then you lift your finger and let the water drain until the meniscus is level with the line. You use it when you want to measure exactly 25 mℓ or 50 mℓ (or any size of the pipette) to add to something.

- Burette: The readings will depend on the size of the spoons.

3.15.7 LEANER SECTION

3.15.8 Content

3.15.8.1 Activity: To measure the volume of liquid substances [LO 1.1, LO 2.3]

MEASURING WITH THE HELP OF A MEASURING CYLINDER

Volume refers to the contents of particular spaces. When you buy a cold drink, you pay for a particular amount of liquid that fills a specific space.

This amount of cold drink can also be described as the volume of cold drink.

Volumes can be measured with the help of a measuring cylinder, a burette or a pipette.

[15] This content is available online at <http://cnx.org/content/m20483/1.1/>.

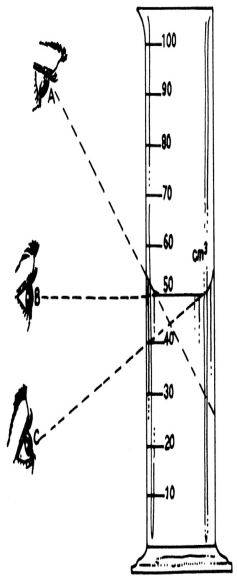

Figure 3.18

Before learning about how to use these measuring instruments, we have to take note of the errors of parallax that might occur and about how to avoid them.

By using a measuring cylinder frequently, you will develop your skill in estimating correctly.

1. Use a typical measuring cylinder to measure the volume of the following containers (and to see how accurate your estimation is):

Container	Estimated volume	Correct volume
Coffee mug	_____	_____
Kettle	_____	_____
Teapot	_____	_____

Table 3.18

Two basic rules have to be considered for taking a correct reading from a measuring cylinder:

- Your eye should be in line with the lower level of the surface of the water (meniscus);
- The measuring cylinder has to be placed on a level surface and not be tilted, as in the illustrated example!

Explain what a meniscus is, using your own words:

_____
_____
_____

MEASURING WITH THE HELP OF A PIPETTE
Study the following illustration to get to know a pipette:

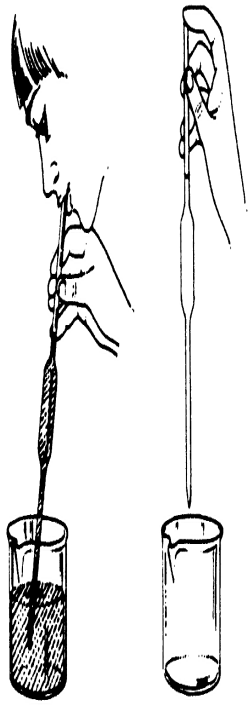

Figure 3.19

ASSIGNMENT 7

- Give your own explanation of how a pipette is used to obtain a reading:

MEASURING WITH THE HELP OF A BURETTE:

A burette is used to measure liquid volume.

It is particularly suitable for measuring volumes smaller than 50 cm.

Burettes are calibrated (marked in divisions) from top to bottom and usually are more accurate than measuring cylinders.

The amount of liquid that is tapped from a burette can simply be read from the burette by checking the level of the meniscus.

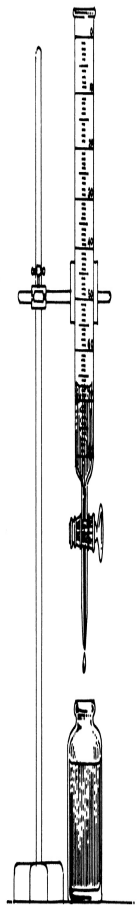

Figure 3.20

Study the burette attentively to be able to discuss its method of working with a partner:

Now use the burette to measure the following volumes:

Object	Estimated volume	Correct volume
Teaspoon	_____	_____
Soup spoon	_____	_____
Tablespoon	_____	_____
Ladle	_____	_____

Table 3.19

3.15.9 Assessment

Learning Outcome 1: The learner will be able to act confidently on curiosity about natural phenomena, and to investigate relationships and solve problems in scientific, technological and environmental contexts.

Assessment Standard 1.1: We know this when the learner plans investigations: plans simple tests and comparisons and considers how to conduct these properly.

Learning Outcome 2: The learner will know and be able to interpret and apply scientific, technological and environmental knowledge.

Assessment Standard 2.3: We know this when the learner interprets information by identifying key ideas in text, finding patterns in recorded data, and making inferences from information in various forms (e.g. pictures, diagrams, text).

3.16 To measure the volume of bodies consisting of solid matter[16]

3.16.1 NATURAL SCIENCES

3.16.2

3.16.3 Matter, measuring and reactions

3.16.4

3.16.5 EDUCATOR SECTION

3.16.6 Memorandum

3. Volume of stone:

3.16.6.1 SCIENTIFIC FORMULA

- You cannot use a formula, because the stone does not have the same length or width in all places.

3.16.6.2 WATER DISPLACEMENT

Take a first reading of the water in the measuring-cylinder. Then bind thread around the stone and lower it into the water-filled cylinder. Wait for all the air bubbles to escape and take the second reading. Subtract the first reading from the second to determine the volume of the stone.

[16] This content is available online at <http://cnx.org/content/m20484/1.1/>.

3.16.7 LEANER SECTION

3.16.8 Content

3.16.8.1 Activity: To measure the volume of bodies consisting of solid matter [LO 1.2]

The examples that follow will help you to understand how volumes of solid bodies are measured.
(We use objects that can be fitted into the measuring cylinder):

Figure 3.21

A cube is a solid that has six square plane faces. The angle between two adjacent angles is a right angle.**V = ℓ3**

Figure 3.22

A triangular prism is a five-sided (polygonal) solid with identical triangular end planes and three rectangular plane faces perpendicular to the end planes.
V = $\frac{1}{2}$bhH

Figure 3.23

A rectangular prism is a six-sided (hexagonal) solid that has two identical rectangular end planes and four side planes perpendicular to the end planes.
V = ℓbh
A cube is a solid that has six square plane faces. The angle between two adjacent angles is a right angle.V = ℓ3 A triangular prism is a five-sided (polygonal) solid with identical triangular end planes and three rectangular plane faces perpendicular to the end planes.V = $\frac{1}{2}$bhH A rectangular prism is a six-sided (hexagonal) solid that has two identical rectangular end planes and four side planes perpendicular to the end planes.V = ℓbh
There are two methods for measuring the volume of the above objects:

- Measuring volume by applying a scientific formula;
- Calculating volume by means of the technique of water displacement.

The water displacement technique operates as follows:

The measuring cylinder is filled with water to the halfway mark. This halfway mark is your first reading of the water level. Now carefully lower the object of which the volume must be measured into the measuring cylinder.

Tap the side of the measuring cylinder to ensure that all air bubbles escape.

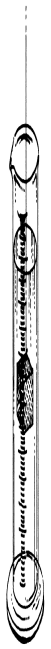

Figure 3.24

Take a reading of the new water level. Deduct the first reading from the second to determine the volume of the object.

1. Now use both these methods to determine the volumes of the given objects:

Object	Volume as calculated	Volume: Water displacement
Metal cube		
Rectangular glass brick		
Prism		

Table 3.20

6 x $\frac{1}{2}$ = (3)

2. Was there any difference between the results obtained by the different methods?

_____
(1)
How do you explain the difference, if any, that you observe?

_____
_____
_____
_____
(2)
3. Explain how you would determine the volume of a stone such as the one illustrated below?

Figure 3.25

- When using a scientific formula:

_____
_____
_____
_____
_____
_____
(2)

- When measuring by means of water displacement:

_____
_____
_____
_____
_____
(2)

3.16.9

3.16.10

3.16.11 Assessment

Learning Outcome 1: The learner will be able to act confidently on curiosity about natural phenomena, and to investigate relationships and solve problems in scientific, technological and environmental contexts.

Assessment Standard 1.2: We know this when the learner conducts investigations and collects data: organises and uses apparatus/equipment or sources to gain and record information.

3.17 To measure mass[17]

3.17.1 NATURAL SCIENCES

3.17.2

3.17.3 Matter, measuring and reactions

3.17.4

3.17.5 EDUCATOR SECTION

3.17.6 Memorandum

Assignment 8:

This works on the principle of the lever. You place the item you want to weigh in the bowl on the one side. Place weights in the bowl on the other side until the lever balances. Calculate the total mass of the weights to determine the mass of the item.

3.17.7 LEANER SECTION

3.17.8 Content

3.17.8.1 Activity: To measure mass [LO 1.2]

ASSIGNMENT 8

Write an explanation of the working of the mass meter.

Figure 3.26

[17] This content is available online at <http://cnx.org/content/m20503/1.1/>.

_____
_____
_____
_____

3.17.8.2 Assessment

Learning Outcome 1: The learner will be able to act confidently on curiosity about natural phenomena, and to investigate relationships and solve problems in scientific, technological and environmental contexts.

Assessment Standard 1.2: We know this when the learner conducts investigations and collects data: organises and uses apparatus/equipment or sources to gain and record information.

3.18 To describe and applythe concept density[18]

3.18.1 NATURAL SCIENCES

3.18.2

3.18.3 Matter, measuring and reactions

3.18.4

3.18.5 EDUCATOR SECTION

3.18.6

3.18.7 Memorandum

- The wood block has the greatest mass.

1. Density = mass per volume. Therefore
   (a) = 1,6 g/cm^3
   (b) = 2,5 g/cm^3
   (c) 8,7 g/cm^3
   (d) = 7,7 g/cm^3
   (e) 0,8 g/cm^3

2. Use two liquids that do not mix. Pour them in a glass jug. The liquid with the lower density will float on the other, e.g. oil on water.

3.18.8 LEANER SECTION

3.18.9 Content

3.18.10 Activity: To describe and applythe concept density [LO 1.1, LO 2.4]

Drop a 50-cent coin and a wooden block into a glass dish that is half full of water. The coin will sink and the wooden block will float.

[18] This content is available online at <http://cnx.org/content/m20504/1.1/>.

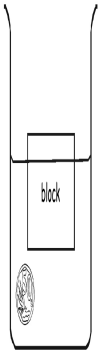

Figure 3.27

- Which one has the greater mass?

The block weighs more than the coin, but floats because it has less density. When we combine the mass and the volume of a substance, we are dealing with the density of the particular substance.

The five blocks below are of equal size, but are made of different substances. The volume of each is exactly 10 cubic centimetres (10 cm3). The approximate mass of each is given.

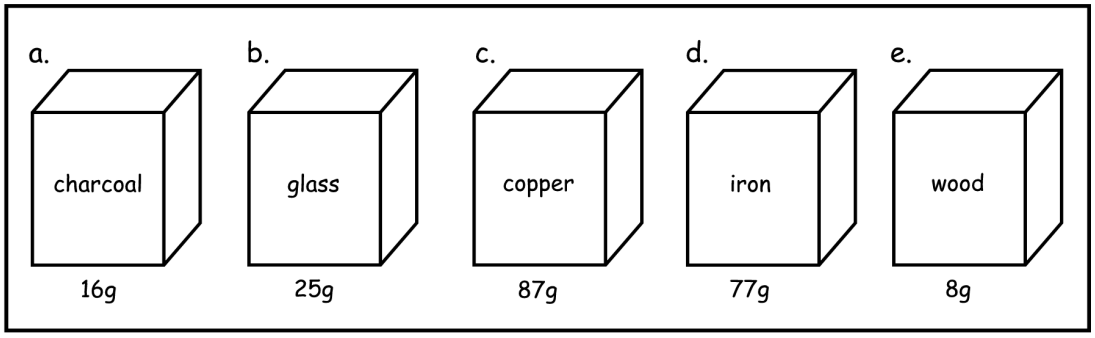

Figure 3.28

We can compare the mass of the five substances because they have the same volume.

The mass in gram of 1 cm of a substance is known as its density.

1. Indicate the density of each of the blocks.

(a)

(b) _____
(c) _____
(d) _____
(e) _____

2. Describe what you would do (with the help of a glass beaker and two liquid substances) to illustrate that the density of different liquid substances also varies. (Suggestion: First decide which liquids you would use).

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

3.18.11

3.18.12 Assessment

Learning Outcome 1: The learner will be able to act confidently on curiosity about natural phenomena, and to investigate relationships and solve problems in scientific, technological and environmental contexts.

Assessment Standard 1.1: We know this when the learner plans investigations: plans simple tests and comparisons and considers how to conduct these properly.

Learning Outcome 2: The learner will know and be able to interpret and apply scientific, technological and environmental knowledge.

Assessment Standard 2.4: We know this when the learner application of knowledge: applies knowledge appropriately by connecting the learnt concept to a variation of the known situation.

3.19 To calculate the density of water[19]

3.19.1 NATURAL SCIENCES

3.19.2 Matter, measuring and reactions

3.19.3 EDUCATOR SECTION

3.19.4 Memorandum

It is important that learners know that the density of water is 1 g/cm^3. This means that 1 litre of water weighs 1 kg.

The assessment proposed in the module is important, also for the learner's portfolio.

[19] This content is available online at <http://cnx.org/content/m20505/1.1/>.

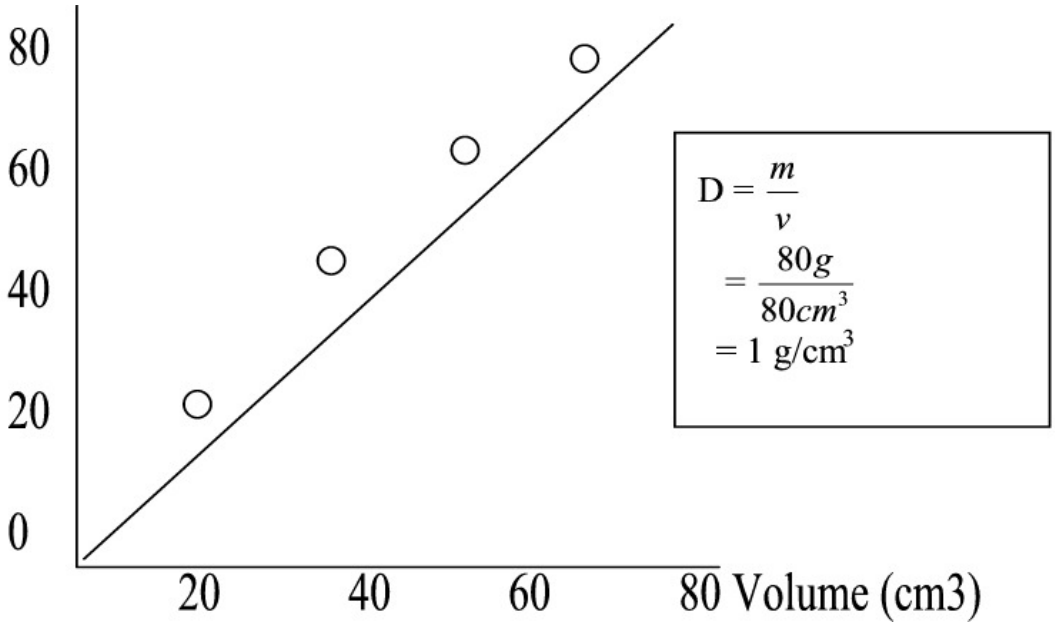

Figure 3.29

3.19.5 LEANER SECTION

3.19.6 Content

3.19.7 Activity: To calculate the density of water [LO 2.3, LO 2.4]

TRANSLATION TASK:

The readings below were obtained after the mass and volume of water were measured:

Reading 1	Reading 2	Reading 3	Reading 4	Reading 5
Mass: 50 gVolume: 50 cm^3	Mass: 30 gVolume: 30 cm^3	Mass: 90 g Volume: 90 cm^3	Mass: 80 gVolume: 80 cm^3	Mass: 60 gVolume: 60 cm^3

Table 3.21

Apply the readings above to a graph to show the different ratios and indicate the density of water. (The density is obtained by dividing the mass by the volume.)

CRITERIA FOR ASSESSING THE TRANSLATION TASK:

1. A suitable heading.
2. Both axes correctly marked.
3. Appropriate scale for both axes.
4. Calculated value of the density is correct.
5. All coordinates are drawn correctly.
6. Density correctly calculated and shown (Density: 1 g/ cm3).

ASSESSMENT ACCORDING TO THE CRITERIA

LO	MARKS	LEVEL	KEY TO LEVEL
1 and 2	1-34%	1	Unable to prepare the graph
	35-39%	2	Up to 4 mistakes on the list of criteria
	40-69%	3	2 or 3 mistakes on the list of criteria
	70-100%	4	No or only one mistake

Table 3.22

LO 2.3	LEVEL
LO 2.4	MARK

Table 3.23

COMMENTS:

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

3.19.8 Assessment

Learning Outcome 2: The learner will know and be able to interpret and apply scientific, technological and environmental knowledge.

Assessment Standard 2.3: We know this when the learner interprets information by identifying key ideas in text, finding patterns in recorded data, and making inferences from information in various forms (e.g. pictures, diagrams, text);

Assessment Standard 2.4: We know this when the learner application of knowledge: applies knowledge appropriately by connecting the learnt concept to a variation of the known situation.

3.20 To test your knowledge[20]

3.20.1 NATURAL SCIENCES

3.20.2 Matter, measuring and reactions

3.20.3 EDUCATOR SECTION

3.20.4 Memorandum

It is important that learners know that the density of water is 1 g/cm^3. This means that 1 litre of water weighs 1 kg.

The assessment proposed in the module is important, also for the learner's portfolio.

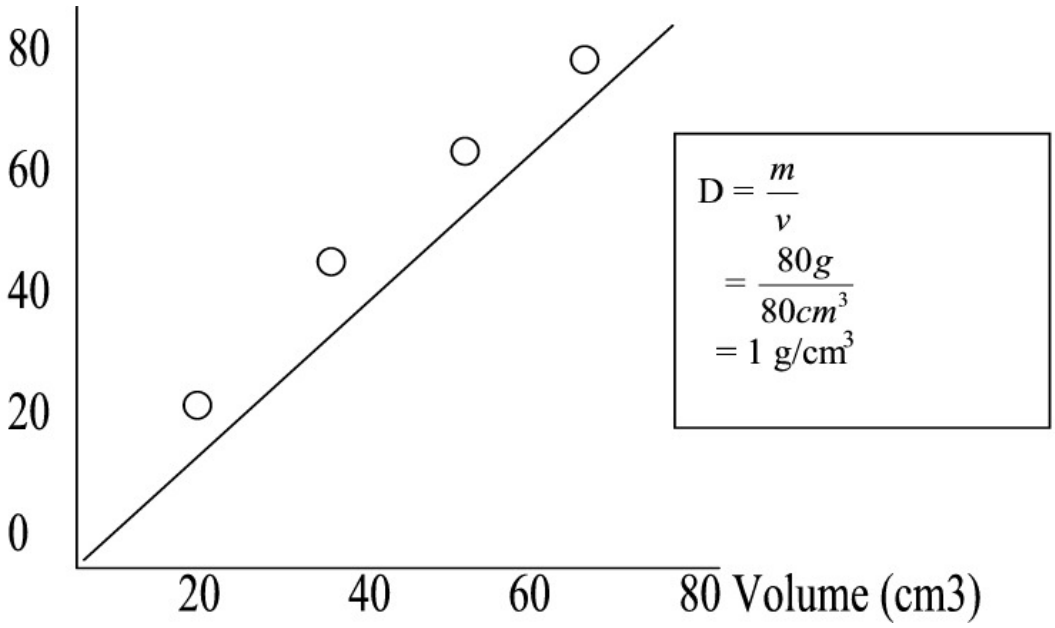

Figure 3.30

3.20.5 LEANER SECTION

3.20.6 Content

3.20.7 Activity: To calculate the density of water [LO 2.3, LO 2.4]

TRANSLATION TASK:

The readings below were obtained after the mass and volume of water were measured:

[20] This content is available online at <http://cnx.org/content/m20512/1.1/>.

Reading 1	Reading 2	Reading 3	Reading 4	Reading 5
Mass: 50 gVolume: 50 cm^3	Mass: 30 gVolume: 30 cm^3	Mass: 90 g Volume: 90 cm^3	Mass: 80 gVolume: 80 cm^3	Mass: 60 gVolume: 60 cm^3

Table 3.24

Apply the readings above to a graph to show the different ratios and indicate the density of water. (The density is obtained by dividing the mass by the volume.)

CRITERIA FOR ASSESSING THE TRANSLATION TASK:

1. A suitable heading.
2. Both axes correctly marked.
3. Appropriate scale for both axes.
4. Calculated value of the density is correct.
5. All coordinates are drawn correctly.
6. Density correctly calculated and shown (Density: 1 g/ cm3).

ASSESSMENT ACCORDING TO THE CRITERIA

LO	MARKS	LEVEL	KEY TO LEVEL
1 and 2	1-34%	1	Unable to prepare the graph
	35-39%	2	Up to 4 mistakes on the list of criteria
	40-69%	3	2 or 3 mistakes on the list of criteria
	70-100%	4	No or only one mistake

Table 3.25

LO 2.3	LEVEL
LO 2.4	MARK

Table 3.26

COMMENTS:

_____
_____
_____
_____
_____
_____
_____
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3.20.8 Assessment

Learning Outcome 2: The learner will know and be able to interpret and apply scientific, technological and environmental knowledge.

Assessment Standard 2.3: We know this when the learner interprets information by identifying key ideas in text, finding patterns in recorded data, and making inferences from information in various forms (e.g. pictures, diagrams, text);

Assessment Standard 2.4: We know this when the learner application of knowledge: applies knowledge appropriately by connecting the learnt concept to a variation of the known situation.

3.21 To identify acids and bases in and around the home[21]

3.21.1 NATURAL SCIENCES

3.21.2 Reactions that occur between different kinds of matter: acids and bases

3.21.3 EDUCATOR SECTION

3.21.4 Memorandum

It is very important that you ensure beforehand that the substances collected by the groups are safe for tasting.

Black tea as indicator.

ACIDS	NEUTRAL	ALKALIS
Salt and vinegar	Vanilla essence (sweet)	Cocoa powder
Spices	Instant soup (salty)	Green pepper
Turmeric	Apple vinegar	Bicarbonate of soda
Lemon juice	Chocolate	

Table 3.27

3.21.5 LEANER SECTION

3.21.6 Content

3.21.7 WARNING

- All people have senses that enable them to observe different aspects of the environment. The tongue is the sense organ that makes it possible to observe the taste of substances. Never taste any substance if you are not altogether sure that it is harmless! People often store substances in containers that do not have the necessary labels. We quite frequently have dangerous substances in our homes, e.g. battery acid, ammonia and pool acid. Remember that it is unwise to taste anything that cannot be identified as harmless.

[21] This content is available online at <http://cnx.org/content/m20513/1.1/>.

3.21.7.1 Activity: To identify acids and bases in and around the home [LO 1.2, LO 2.2]

Most acids have a sour taste, while most bases are bitter. The rear area of the tongue identifies these tastes. The foremost part of the tongue records the taste of substances that are sweet or salty. Substances such as these are neither acids nor bases, but are neutral.

Check through your mother's kitchen cupboards and bring some of the following to school with you:

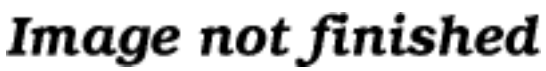


Figure 3.31

Toothpaste

- Ask your mother to help you ensure that you do not bring dangerous substances like ammonia or bleaching agents to school with you.
- Form groups and draw up lists of the substances that you have in your group.
- Get your educator's help in ensuring that all the substances are safe to taste.

Complete the following table by tasting all the substances and recording your observations.

ACIDSThese substances have a sour taste	NEUTRALThese substances taste neither sour nor bitter	BASESThese substances have a bitter taste
_____		
_____		
_____		
_____		
_____		

Table 3.28

(15)

Compare your personal experience with the experiences of the other members of the group. Classify the substances in your group according to their taste. Compare your notes with those of the other groups.

- Did everyone agree about the tastes of all the substances? _____
- If everyone did not agree, indicate where the differences occurred?

_____
_____
_____
_____
_____
_____

3.21.7.2 Assessment

Learning Outcome 1: The learner will be able to act confidently on curiosity about natural phenomena, and to investigate relationships and solve problems in scientific, technological and environmental contexts.

Assessment Standard 1.2: We know this when the learner conducts investigations and collects data: organises and uses apparatus/equipment or sources to gain and record information.

Learning Outcome 2: The learner will know and be able to interpret and apply scientific, technological and environmental knowledge.

Assessment Standard 2.2: We know this when the learner categorises information.

3.22 To identify acids and bases with the help of indicators[22]

3.22.1 NATURAL SCIENCES

3.22.2 Reactions that occur between different kinds of matter: acids and bases

3.22.3 EDUCATOR SECTION

3.22.4 Memorandum

1. **Coffee:** Acidic (4 to 5)
2. **Shampoo:** Acidic (4 to 5)
3. **Fruit salt solution:** Acidic (0 to 3)
4. **Tartaric acid:** Acidic (0 to 3)
5. **Lemon juice:** Acidic (0 to 3)

3.22.5 LEANER SECTION

3.22.6 Content

3.22.7 Activity: To identify acids and bases with the help of indicators [LO 1.2, LO 1.3]

As there are many substances that are dangerous to the taste, we will be using safer methods for determining which substances are acids and which are alkalis.

We shall be using:

- black tea
- bromothymol blue
- litmus paper / litmus solution

When a driver plans to turn to the left, he or she uses a flickering light to signal this intention. This flickering light serves as an indicator. The above-mentioned agents will give an indication of whether substances are acidic, alkaline or neutral. They are called chemical indicators.

BLACK TEA

Pour approximately 5 cm^3 (5 ml) of black tea to each test tube, as shown in the following sketch.

[22] This content is available online at <http://cnx.org/content/m20514/1.1/>.

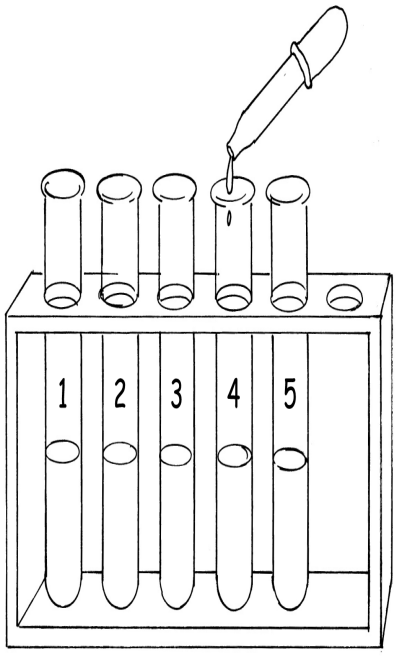


Figure 3.32

Then add:

- a little vinegar to test tube no. 1
- some lime juice to test test tube no. 2
- some bicarbonate of soda to test tube no. 3
- a little milk of magnesia to test tube no. 4.

The tea in the fifth test tube will be used as a reference when making observations of reactions in other test tubes.

- Observe what happens and complete the table that is provided for recording your observations:

SUBSTANCE: DESCRIBE THE COLOUR CHANGE

Substance	Describe the colour change
• Vinegar	

continued on next page

• Lime juice	_____
• Bicarbonate of soda	_____
• Milk of magnesia	_____

Table 3.29

Complete the following deductions:

- When an acid (vinegar/lime juice) is added to black tea, the solution

_____
_____

- But when an alkali (bicarbonate of soda / milk of magnesia) is added to black tea, the solution

_____
_____

BROMOTHYMOL BLUE

Pour approximately 5 cm^3 (5 ml) pure water into each test tube as shown in the following sketch.

Add 5 drops of Bromothymol blue to the water in each test tube. The Bromothymol blue should now have a greenish tinge. Consider the following statement when you do a test to determine whether the next substances are acids of bases:

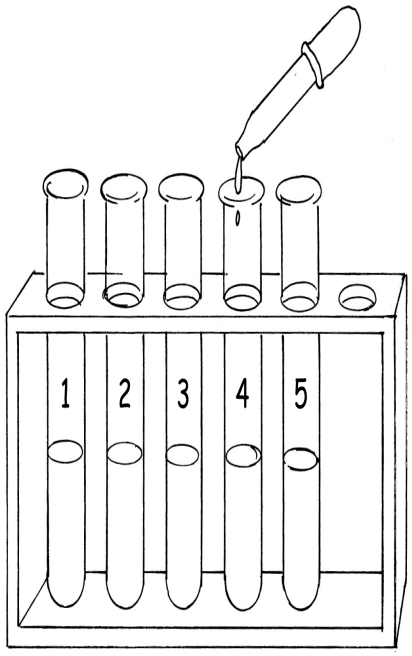


Figure 3.33

Bromothymol blue becomes yellow in an acid solution, but looks blue when it is in contact with a base. The colour does not change when it is added to a neutral solution.

Substance	Acid	Base	Neutral
• Water	_____	_____	_____
• Tartaric acid	_____	_____	_____
• Salt	_____	_____	_____

continued on next page

• Ammonia	_____	_____	_____

Table 3.30

LITMUS PAPER

Use blue or red litmus paper to establish whether the following substances are acids or bases.

Place a drop of each solution on the litmus paper. If the substance is a powder, it should first be dissolved in water. Insoluble substances could be mixed with water to form a paste.

Baking powder	_____	Beer	_____
Bicarbonate of soda	_____	Icing sugar	_____
Shaving cream	_____	Hair shampoo	_____
Milk	_____	Coffee	_____
Salad dressing	_____	Carbonated cold drink	_____

Table 3.31

3.22.8 Assessment

Learning Outcome 1: The learner will be able to act confidently on curiosity about natural phenomena, and to investigate relationships and solve problems in scientific, technological and environmental contexts.

Assessment Standard 1.2: We know this when the learner conducts investigations and collects data: organises and uses apparatus/equipment or sources to gain and record information;

Assessment Standard 1.3: We know this when the learner evaluates data and communicates findings: generalises in terms of relevant aspects and describes how the data support the generalisation.

3.23 To measure the acidity or alkalinity of substances[23]

3.23.1 NATURAL SCIENCES

3.23.2 Reactions that occur between different kinds of matter: acids and bases

3.23.3 EDUCATOR SECTION

3.23.4 Memorandum

1. **Coffee:** Acidic (4 to 5)
2. **Shampoo:** Acidic (4 to 5)
3. **Fruit salt solution:** Acidic (0 to 3)
4. **Tartaric acid:** Acidic (0 to 3)
5. **Lemon juice:** Acidic (0 to 3)

[23] This content is available online at <http://cnx.org/content/m20516/1.1/>.

3.23.5 LEANER SECTION

3.23.6 Content

3.23.7 Activity: To measure the acidity or alkalinity of substances [LO 1.2]

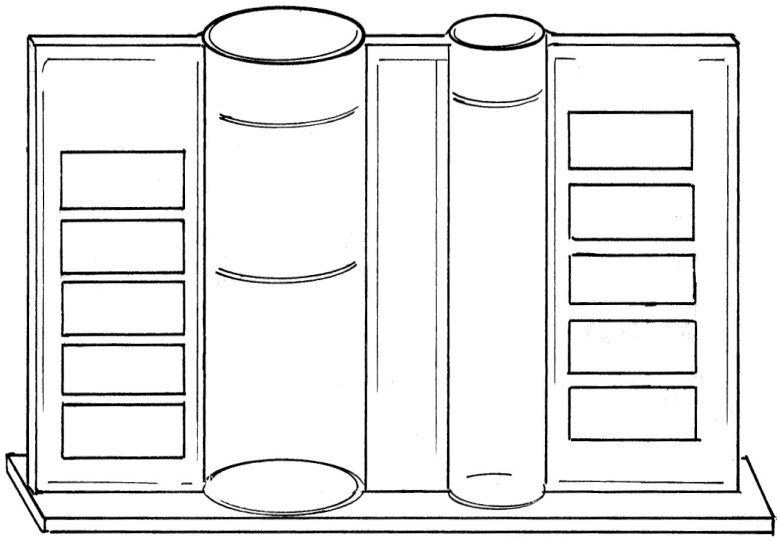


Figure 3.34

A universal indicator uses a range of colours to indicate acidity or alkalinity. The pH scale is specially designed to enable us to make a decision about the degree of acidity or alkalinity of a substance. On this scale, the pH value of 7 is equal to neutral and values below 7 are acidic, while those above 7 are alkaline.

- The following illustration shows the approximate values of a number of household substances.

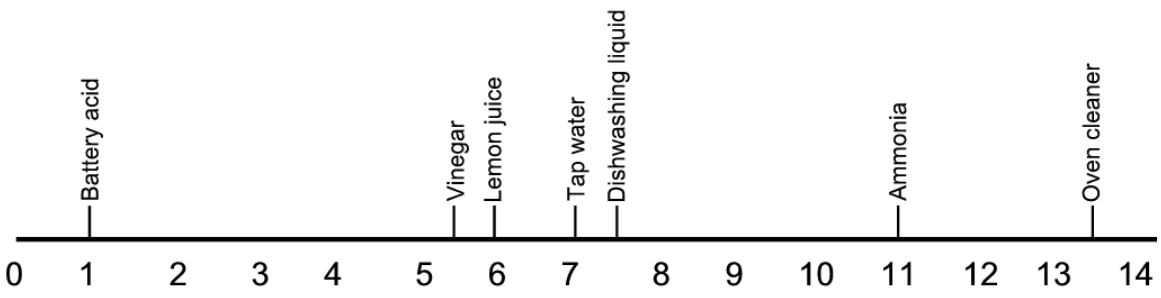


Figure 3.35

Use a universal indicator (a pH meter) to determine the acidity or alkalinity of the following substances:

1. coffee _____
2. hair shampoo _____
3. fruit salts solution _____
4. tartaric acid _____
5. lemon juices _____

3.23.8 Assessment

Learning Outcome 1: The learner will be able to act confidently on curiosity about natural phenomena, and to investigate relationships and solve problems in scientific, technological and environmental contexts.

Assessment Standard 1.2: We know this when the learner conducts investigations and collects data: organises and uses apparatus/equipment or sources to gain and record information.

3.24 To determine what happens when an acid and an alkali are mixed[24]

3.24.1 NATURAL SCIENCES

3.24.2 Reactions that occur between different kinds of matter: acids and bases

3.24.3 EDUCATOR SECTION

3.24.4 Memorandum

Step 1: It turned blue, because bicarbonate of soda is an alkali
Step 2: No
Step 3: It became lighter
Step 4: It becomes much lighter and lime green
OBSERVATION:

- Neutral

[24] This content is available online at <http://cnx.org/content/m20517/1.1/>.

3.24.5 LEANER SECTION

3.24.6 Content

3.24.6.1 Activity: To determine what happens when an acid and an alkali are mixed [LO 1.2, LO 1.3]

We have already discovered that a neutral solution is neither an acid nor a base.
What can we expect to happen when and acid and a base are mixed together? Let's find out!

- Use a Bromothymol blue solution as indicator
- Other requirements:
- 100 ml white vinegar
- 150 ml bicarbonate of soda solution

STEP 1: Add a few drops of the bicarbonate of soda solution to the

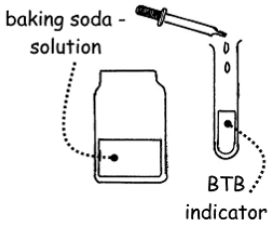


Figure 3.36

Bromothymol blue indicator.
What do you observe?

_____
_____
_____
_____

STEP 2: Add half of the vinegar to the bicarbonate of soda solution

Figure 3.37

Does this make the solution neutral?

_____

_____

STEP 3: To determine this, you have to add drops of the mixture to the Bromothymol blue indicator.

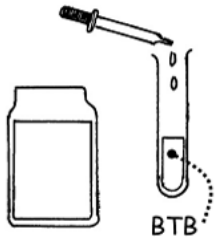


Figure 3.38

What do you observe?

_____

_____

_____

_____

STEP 4: If no change has occurred, add half of the remaining vinegar to the bicarbonate of soda solution and repate step 3.

Figure 3.39

STEP 5: Test the solution again and repeat steps 3 and 4 until there is a change.

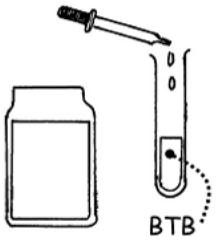


Figure 3.40

What do you observe?

_____
_____
_____
_____

OBSERVATION:

- The vinegar and bicarbonate of soda formed a_____ solution. It is neither an acid nor a base.

The process by which acids are destroyed by bases, or bases by acids, is called **NEUTRALISATION.**

3.24.7 Assessment

Learning Outcome 1: The learner will be able to act confidently on curiosity about natural phenomena, and to investigate relationships and solve problems in scientific, technological and environmental contexts.

Assessment Standard 1.2: We know this when the learner conducts investigations and collects data: organises and uses apparatus/equipment or sources to gain and record information;

Assessment Standard 1.3: We know this when the learner evaluates data and communicates findings: generalises in terms of relevant aspects and describes how the data support the generalisation.

3.25 To discuss the effect of acids and bases on everyday phenomena[25]

3.25.1 NATURAL SCIENCES

3.25.2 Reactions that occur between different kinds of matter: acids and bases

3.25.3 EDUCATOR SECTION

3.25.4 Memorandum

Assignment 9:

a) Heartburn and peptic ulcers are caused by acids. An acid can be neutralised by an alkali. I will therefore drink an alkali to neutralise acids. The best household substances are milk or bicarbonate of soda, because they are alkalis that can neutralise heartburn. Also avoid the use of aspirin (acid).

[25] This content is available online at <http://cnx.org/content/m20518/1.1/>.

b) A bee-sting is also acidic and needs to be neutralised with an alkali. I will put a bicarbonate of soda solution on the sting mark in order to neutralise the sting.

c) Since the sting is alkaline, it can be neutralised by putting an acid like vinegar/brandy on it.

d) Eat foods that contain less acids and are more alkaline or neutral. Avoid certain types of fruit, like oranges, tomatoes and fruit juices. Use a toothpaste that is more alkaline.

3.25.5 LEANER SECTION

3.25.6 Content

3.25.7 Activity: To discuss the effect of acids and bases on everyday phenomena [LO 2.3]

Figure 3.41

A doctor made the discovery that the stomach contains hydrochloric acid to help with the digestion of food. He attached a small sponge to a string and swallowed it. After a while he retracted the sponge from his stomach and found that it was acidic. Sometimes people have an excess of hydrochloric acid and then suffer from heartburn. (a)

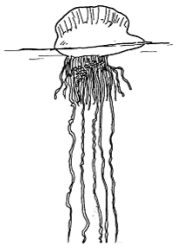


Figure 3.42

When a honeybee stings, a kind of acid is injected into the skin, while a wasp injects an alkali. Any bee sting really stings! (b)

Figure 3.43

The Portuguese man-of-war that is sometimes seen floating on the sea is also able to inflict a lot of pain when it comes into contact with your skin. The substance that causes pain is alkaline. (c)

The foodstuffs that we eat also contain many acids, which cause tooth decay. (d)

Figure 3.44

ASSIGNMENT 9

Study the information in (a) – (d) and suggest household substances that could relieve or prevent the discomfort or effects caused by the above substances and explain why you have selected these particular substances.

(a) _____
_____
_____
_____
(2)

(b) _____
_____
_____
_____
(2)

(c) _____
_____
_____
_____
(2)

(d) _____
_____
_____
_____

_____
_____
(3)

3.25.8 Assessment

Learning Outcome 2: The learner will know and be able to interpret and apply scientific, technological and environmental knowledge.

Assessment Standard 2.3: We know this when the learner interprets information by identifying key ideas in text, finding patterns in recorded data, and making inferences from information in various forms (e.g. pictures, diagrams, text).

3.26 To name well-known acids and bases and their functions[26]

3.26.1 NATURAL SCIENCES

3.26.2 Reactions that occur between different kinds of matter: acids and bases

3.26.3 EDUCATOR SECTION

3.26.4 Memorandum

3.26.5 LEANER SECTION

3.26.6 Content

3.26.6.1 Activity: To name well-known acids and bases and their functions [LO 2.1]

(A) ACIDS AND SOME OF THEIR FUNCTIONS

- Hydrochloric acid

used for cleaning brickwork and cement;
reduces the pH levels of swimming pool water.

- Nitric acid

used in artificial fertilisers, dyes and explosives;
present in plastics.

- Sulphuric acid

probably the most important acid in South Africa;
an effective drying agent;
used in the preparation of fertilisers, dyes, paper and glue.

- Phosphoric acid

used to flavour cold drinks;
used by dentists in dental cement.

- Boric acid

used in many disinfectants;
an effective germicide.

[26] This content is available online at <http://cnx.org/content/m20520/1.1/>.

- Citric acid

the acid contained in oranges (citrus fruit).

- Oxalic acid

the acid contained in tomatoes.

- Tartaric acid

used in baking powder.

- Acetylsalicylic acid

the acid in aspirin tablets.

- Ascorbic acid

this is vitamin C.

- Lactic acid

the acid formed when milk turns sour;
lactic acid is also formed in muscles, particularly after vigorous exercise.
(B) BASES AND SOME OF THEIR FUNCTIONS

- Sodium hydroxide

used in the manufacturing of soap;
(also known as caustic soda)
used as a cleanser in drainage pipes.

- Calcium hydroxide

present in milder soaps;
(lime water/whitewash)
used in the agricultural and building.Industries

- Magnesium hydroxide

this is used as a purgative, as well as for other purposes (purgatives encourage the evacuation of the bowels).

- Ammonia

is a general domestic cleaning agent;
is used as smelling salts (sal volatile) because of its pungent smell;
also is an ideal stain remover
Test:
Try to list at least eight acids and three alkalis and their uses (on a separate sheet of paper).

3.26.7

3.26.8 Assessment

Learning Outcome 2: The learner will know and be able to interpret and apply scientific, technological and environmental knowledge.

Assessment Standard 2.2: We know this when the learner categorises information.

3.27 Test your knowledge[27]

3.27.1 NATURAL SCIENCES

3.27.2 Reactions that occur between different kinds of matter: acids and bases

3.27.3 EDUCATOR SECTION

3.27.4 Memorandum

1. Bitter; slippery/smooth
2. Yellow
3. Indicator
4. Alkali
5. Lime; neutralise
6. Saltpetre; phosphorous
7. Universal indicator

3.27.5 LEANER SECTION

3.27.6 Content

3.27.6.1 Activity: Test your knowledge [LO 2.1]

You may refer to the contents of the module to help you with the following closing exercises, which will serve as a summary of the main facts to be used when you prepare for the module test.

1. Bases taste _____ and feel _____
2. When the acidity or alkalinity of a substance has to be established, it can be added to a Bromothymol blue solution. If the colour changes to_____ we know that the added substance is an acid.
3. A _____ e.g. black tea, can also be used to establish whether a substance is an acid or a base.
4. When a little caustic soda is dissolved in water and a few drops of this solution are placed on red litmus paper the paper will become blue. This indicates that caustic soda is_____
5. Most crops, and vegetables in particular, need neutral soils for optimal growth. If the soil contains too much acid, farmers add _____to the soil to _____ the acid in the soil.
6. _____ acid is present in plastics and _____ acid is used to flavour cold drinks.
7. A _____ is used to determine the level of alkalinity or acidity in substance.

3.27.7 Assessment

Learning Outcome 2: The learner will know and be able to interpret and apply scientific, technological and environmental knowledge.

[27] This content is available online at <http://cnx.org/content/m20521/1.1/>.

Assessment Standard 2.1: We know this when the learner recalls meaningful information: the minimum requirement is an ability to recall definitions and complex facts.

3.28 To find out about acid rain[28]

3.28.1 NATURAL SCIENCES

3.28.2 Reactions that occur between different kinds of matter: acids and bases

3.28.3 EDUCATOR SECTION

3.28.4 Memorandum

Assignment 10:

Use the control list as basis for assessment.

Supplementary reading for Activity Research Assignment.

3.28.5 LEANER SECTION

3.28.6 Content

3.28.7 Activity: To find out about acid rain [LO 1.1, LO 1.2, LO 1.3, LO 3.2]

ASSIGNMENT 10

"Burning coal releases sulphur dioxide which causes rain to fall as acid rain. This disturbs the chemical balance of the soil and prevents plants from growing properly".

Do research on the formation of acid rain and the effect that it has on the environment. The following scientific process has to be followed for this investigative research project. Steps 1 – 7 must form part of the investigation. Step 7 involves preparing a report to be submitted to a policy-making body like the government, for instance.

FOCUS and planning of projects	Collecting and processing of DATA	DATA analysis	Communication of findings
1.Statement of the problem that will be investigated. The purpose/outcome of the project is to solve the problem.	3.Collecting DATA on the subject, e.g. by using the internet, libraries, interviews, questionnaires, etc.	5.Obtaining results. These have to be recorded, analysed and evaluated. It will determine future planning or a repeat of the process.	7.Reporting. This can be done in various ways, e.g. by means of a written document.

continued on next page

[28] This content is available online at <http://cnx.org/content/m20522/1.1/>.

2.Formulating a hypothesis*. This makes it possible to predict a possible solution. It can be shown as correct or incorrect.	4.Using data and investigation by means of experimentation, observation, etc.	6.Deduction. This is where the hypothesis is shown to be correct or wrong.	

Table 3.32

*Hypothesis: Preliminary statement that still has to be proven.
RESEARCH

CHECKLIST: INVESTIGATIONSUBJECT: ACID RAIN			
CRITERIA	[U+F034]		
1. I started doing research in good time.	Yes	No	
2. I have worked through and have followed all the steps (1 to 7).	Yes	No	
3. I have used more than one source and have attached a list of sources.	Yes	No	
4. I have widened my knowledge of the subject and have made meaningful suggestions.	Yes	No	
5. I enjoyed doing research on this specific subject.	Yes	No	
PROBLEM s I have encountered :			

Table 3.33

HAVING FUN WITH ACIDS AND BASES

Try the following at home and report your findings to the class.

SECRET WRITING

Use lemon juice as ink and write some message on a piece of white paper, then leave it to dry. Hold the paper close to a heater for approximately 5 minutes. (Take care that you do not come too close!) The writing will become legible because the lemon juice will react with the starch in the paper to form a brown sugar.

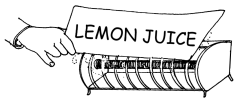


Figure 3.45

MAKING FOAM

Drip a little vinegar onto 10 ml of bicarbonate of soda. What do you observe? Add some more vinegar. Find out how the principle that is demonstrated here is used for extinguishing fires.

Figure 3.46

GUIDELINES FOR ASSESSMENT:

The learner's progress towards gaining an acceptable level of performance has to be measured. The following table provides guidelines for assessing the different tasks set for assessment and indicates the performance levels.

Grid for process skills (L0 1)				
Level	Focus and planning of investigations	Collecting and processing of data	Analysis of Data	Communication of findings
1	Identifies phenomena independently. **Formulates** questions for investigations. **Refines** questions with the necessary support.	Organises and collects equipment for collecting data with the help of the group. Some steps are understood adequately, but most lack detail.Observation should be more meaningful. Writing down of data is clear. Tables and / or graphs for recording data lack information and inaccuracies occur.	**Discusses observations and possible explanations** The largest portion of the discussion deals with investigations. Identifies some general tendencies in the data.Makes some deductions.	Provides too much oral and / or written information on expected findings, no organisation of material.

continued on next page

2.	Identifies phenomena independently. **Formulates** questions from investigations and refines them. Formulates a plan of action with reference to a variable with the help of the educator.	Uses instruments and techniques in the group to collect accurate and dependable data. Shows understanding of most of the steps but lacks some detail. Makes meaningful and appropriate observations. Table and / or graph complete and accurate, some poorly formed characters. A degree of sorting or classification of data is present.	Discusses observations and possible explanations.Discussion is relevant to the investigations and includes further interesting facts.Identifies tendencies, patterns and groupings in the data. Gives consideration to the reliability of some tendencies. Makes deductions and relates observations and explanations to other conditions.	Provides too much oral and written information on expected findings; no organisation of material.

continued on next page

3	Identifies phenomena. **Formulates** and refines questions to support the plan of action of the investigation with reference to variables. Selects appropriate avenues of investigation relevant to the **purpose and resources,** and with attention to the means **by which a variable can be controlled. Designs simple tests to control a variable.**	Selects instruments and techniques for collecting accurate and reliable data from more than one source as part of a group and / or individually. **Presents logical steps that are easy to follow.** Makes meaningful and reliable observations with regard to one variable. **Table and / or graph for recording data completed neatly and altogether accurately. Signs of logical sorting or classification of some of the data.**	**Discusses observations and possible explanations. All discussion related to investigations and inclusive of some other facts.** Relates observations and explanations to other situations. **Identifies tendencies, patterns and groupings in the data.** Gives consideration to the reliability and validity of most of the findings. Makes deductions to provide reasonable answers.Evaluates deductions against personal experience.	Provides expected information and findings in a logical form. Uses different methods of presentation to enhance understanding. Communicates and presents findings by means of a neat report.

continued on next page

4	Identifies phenomena and the relationships between different phenomena. **Formulates and refines questions in support of the plan of action** for the investigation with reference to variables. Selects appropriate avenues of investigation for the investigation with regard to the purpose and resources and with particular attention to means of controlling the variables. **Develops tests for controlling variables. Plans procedures for investigating hypotheses and predictions for two variables. Identifies the advantages and restrictions** of controlled experiments. **Selects instruments for collecting usable qualitative and quantitative data from at least three different sources.**	Individually selects instruments and techniques for collecting usable, accurate, reliable quantitative and qualitative data from at least three different sources.**Presents more complex and logical steps.** Makes complex, accurate observations regarding more than one variable. **Table and / or graph for recording data both neatly completed and fully accurate (independent variable on x-axis).**Indications of logical sorting or classification of all data to identify patterns.	**Discusses observations and possible explanations.** All discussion relates to investigations and also includes other interesting tendencies, patterns and groupings of data. Gives consideration to the reliability and validity of all findings. **Offers a logical explanation for all findings and gives attention to most of the questions related to the investigation through logical deductions and by relating it to other situations.** Makes deductions based on collected data and personal experience and suggests possible improvements to the investigations in cooperation with other group members. **Assesses deductions with reference to further evidence and sources.**	Provides all required information and findings in logical form. Communicates and offers the findings and information in an appropriate and easily understood form.

Table 3.34

3.28.8 Assessment

Learning Outcome 1: The learner will be able to act confidently on curiosity about natural phenomena, and to investigate relationships and solve problems in scientific, technological and environmental contexts.

Assessment Standard 1.1: We know this when the learner plans investigations: plans simple tests and comparisons and considers how to conduct these properly;

Assessment Standard 1.2: We know this when the learner conducts investigations and collects data: organises and uses apparatus/equipment or sources to gain and record information;

Assessment Standard 1.3: We know this when the learner evaluates data and communicates findings: generalises in terms of relevant aspects and describes how the data support the generalisation:

Learning Outcome 3: The learner will be able to demonstrate an understanding of the interrelationships between science and technology, society and the environment.

Assessment Standard 3.2: We know this when the learner understands sustainable use of the earth's resources: analyses information related to renewable and non-renewable sources.

Chapter 4

Term 4

4.1 To give an overview of the solar system[1]

4.1.1 NATURAL SCIENCES

4.1.2

4.1.3 Planet earth and the universe

4.1.4

4.1.5 Our Solar System

4.1.6

4.1.7 EDUCATOR SECTION

4.1.8

4.1.9 Memorandum

Assignment 1:

Asteroids: These are pieces of rock that are found in an orbit around the sun in a small area between the orbits of Mars and Jupiter.

Comets: Comets are huge, dirty snowballs with a diameter of between one and approximately 50 kilometres. If they pass near the sun the ice can be melted into a gas as a result of the heat of the sun.

Meteors: These are small pieces of rock that move around in space and burn up. They are visible when they penetrate the earth's atmosphere. Sometimes they are called shooting stars and they appear to be balls of fire. Sometimes larger meteors do not completely burn up and when they hit the earth's surface they create craters. When a meteor hits the earth it is known as a meteorite.

Assignment 2:

- The Greek word "cometes" means "hairy star". When comets pass near the sun ice changes into gas. Dust is also freed from the ice and from the earth this dust can be seen as a long tail which turns away from the sun. It looks like hair, thus the name "hairy star".
- This comet appears every 76 years when it passes the earth in its orbit around the sun.
- The comet appeared twice in the 20^{th} century, in 1910 and 1986.
- Yes, if one is born close to the appearance of the comet, it is possible to see it a second time.
- Own research

[1] This content is available online at <http://cnx.org/content/m20534/1.1/>.

4.1.10 LEANER SECTION

4.1.11 Content

4.1.11.1 Activity: To give an overview of the solar system [LO 1.1]

Read the section below carefully and answer the following questions.

4.1.11.2 THE SOLAR SYSTEM

The earth is part of a group of planets and bodies which is called the solar system. The sun is the central point of the universe and the other bodies orbit around it. The sun is actually a star and is much bigger than the members of the solar system. The planets shine because they reflect the sun's light.

There are nine planets: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune and Pluto. All the planets have moons except for Mercury and Venus. Some planets, like Earth, have only one moon but others have more. Saturn has seventeen.

- The sun also has smaller family members, for example meteors, asteroids and comets. Most asteroids revolve around the sun in smaller orbits.

TASK 1

Use a dictionary and define the following:

1. Asteroids:

_____
_____
_____
_____

2. Comets:

_____
_____
_____
_____

3. Meteors:

_____
_____
_____
_____

TASK 2

The astronomer Edmund Halley predicted in 1705 that a comet would appear in 1758. He was right. He calculated in which year the same comet would re-appear. He had already died by the time the comet re-appeared and in his honour the comet was named after him.

- Write a short report on Halley's comet in which you discuss the following aspects:
- Why was the word "comet" derived from the Greek word "cometes" which means "hairy star"?
- How often does the comet re-appear? Why does it appear when it does?
- How many times did it appear in the 20th Century (1901 to 2000)?
- Is it humanly possible to see the comet twice?
- Make short notes about Edmund Halley's life.

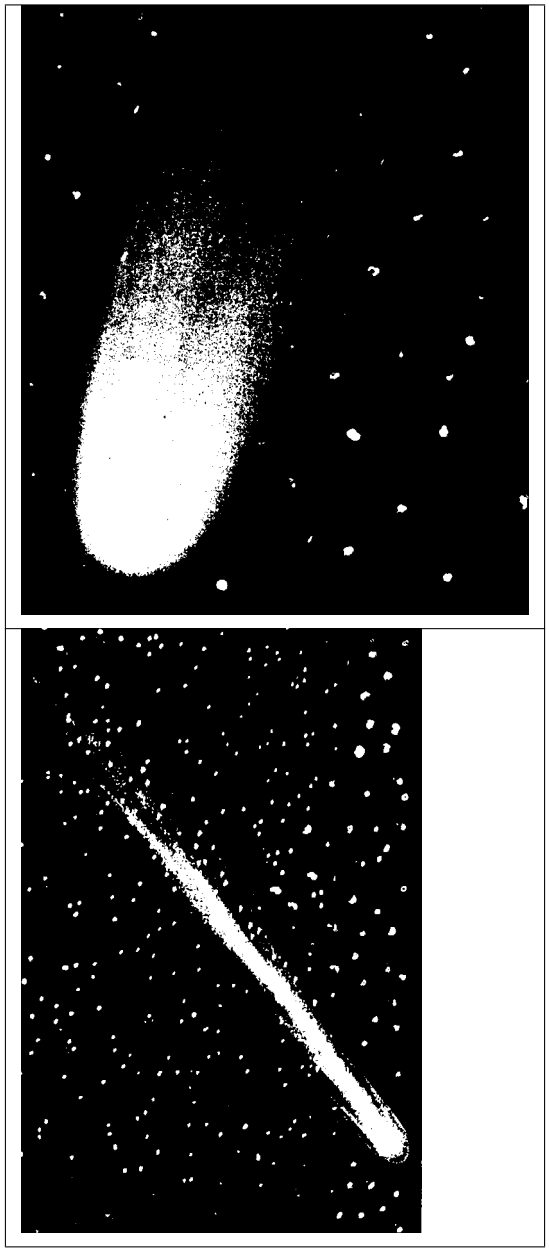


Table 4.1

Research project: Edward Halley Educator Assessment

CRITERIA	1	2	3	4

continued on next page

TECHNICAL PRESENTATION:				
• Cover page: Subject indicated; Name				
• Neatness				
• Handed in on time				
• Prescribed length				
CONTENTS:				
• Subdivisions indicated				
• Information logically presented				
• Interesting facts included				
• Concluding paragraph?				

continued on next page

• Illustrations or pictures?				
LANGUAGE USE				
• Paragraphs used				
• Correct language usage				
• Punctuation				
EVIDENCE OF RESEARCH				
• Sources indicated				
• Sources correctly listed				
• All questions answered				
OVERALL CODE				
CONVERT TO MARK:0% - 34%: 135% - 39%: 240% - 69% 370% - 100% 4	Percentage awarded: %			

Table 4.2

Comment: _____
_____
_____
Educator:_____

4.1.12 Assessment

Learning Outcome 1: The learner will be able to act confidently on curiosity about natural phenomena, and to investigate relationships and solve problems in scientific, technological and environmental contexts.

Assessment Standard 1.1: We know this when the learner plans investigations: plans simple tests and comparisons, and considers how to make them fair.

4.2 To investigate the properties of the sun and to explain concepts such as "constellations" and the "exploration of space"[2]

4.2.1 NATURAL SCIENCES

4.2.2 Planet earth and the universe

4.2.3 Our Own Star – the Sun

4.2.4 EDUCATOR SECTION

4.2.5 Memorandum

Assignment 3:

Hubble space telescope: This is an instrument which allows astronomers to more of the universe than can be seen with the naked eye. The Hubble Space Telescope is the largest telescope in space. It was launched in 1990 by the USA.

Satellites: We make a distinction between natural satellites and man-made satellites. Natural satellites are celestial bodies that orbit around other celestial bodies. Planets are satellites of the sun. Artificial or man-made satellites are instruments designed to send information to the earth. These satellites are put in an orbit around the earth. Satellites take fixed times to complete their orbits.

Robot Exploration Vehicles; Robot vehicles are unmanned spacecraft. They can be used to explore the moon and the planets. Some orbit planets to explore them, but don't land on them.

4.2.6 LEANER SECTION

4.2.7 Content

4.2.7.1 Activity: To investigate the properties of the sun and to explain concepts such as "constellations" and the "exploration of space" [LO 1.2]

- The sun is an ordinary star in the Milky Way (our galaxy). It is an incredibly large revolving ball of gas with a diameter of 1,4 million kilometres. This is more than a hundred times more than the earth's diameter. The sun is 150 million kilometres from the earth and it takes 8 minutes for the light from the sun's surface to reach the earth.
- The sun develops so much energy that its surface glows white-hot at a temperature of 6 000 degrees Celsius. The energy originates at the centre of the sun as a result of nuclear activity. The sun has been shining for about 4,5 milliard years. After another 5 milliard years the sun's supply of hydrogen will be exhausted. No life can exist on Earth without sunlight.
- The sun is vital for life on Earth. It supplies almost all the energy that we have to our disposal. Even the coal that we burn originally was forests of which the growth was sustained by the energy from the sun. No life on Earth will survive if the sun stops shining.
- The universe is so big that astronomers measure it in light-years. A light-year is the distance that light travels in one year – 9,5 million kilometres. Light moves at 300 000 kilometres a second.

[2] This content is available online at <http://cnx.org/content/m20536/1.1/>.

CONSTELLATIONS

- Astronomers have divided the universe into constellations. The first astronomer to investigate the Southern Cross from South Africa was Guy Tachard in 1685. This constellation appears on the flags of New Zealand and Australia.

Figure 4.1

Figure 4.2

- The three stars of Orion's Belt lie in a straight line. It is probably the constellation which is most easy to recognize in the Southern Hemisphere. Orion is named after a hunter of Greek mythology. Some of the stars form his belt.

TASK 3

- The telescope is an instrument which astronomers use. Large telescopes are housed in special buildings called observatories. The exploration of space would not have been possible without telescopes, satellites and unmanned spacecraft.

Write a short paragraph (6 -10 lines) on each of the following unmanned spacecrafts:

- Hubble space telescope
- Satellite
- Robot exploratory craft

_____
_____
_____
_____
_____
_____
_____
_____

CRITERIA FOR ASSESSING PARAGRAPHS

	Level 4	Level 3	Level 2	Level 1
Planning and coherence of structure:	thorough planning, logical and effective	planning sufficient, correct sentence structure	little evidence of planning, faulty sentence construction	no evidence of planning, many errors in sentence construction
Correctness of information:	information correct, very interesting, shows creativity	information correctly given	information not entirely accurate	information is full of factual errors
Presentation:	extremely neat, orderly and creative	presentation is neat and orderly	presentation slightly confused and untidy	presentation not at all structured, untidy

Table 4.3

4.2.8 Assessment

Learning Outcome 1: The learner will be able to act confidently on curiosity about natural phenomena, and to investigate relationships and solve problems in scientific, technological and environmental contexts.

Assessment Standard 1.2: We know this when the learner conducts investigations and collects data: organises and uses apparatus/equipment or sources to gain and record information.

4.3 To discuss the planets of our solar system[3]

4.3.1 NATURAL SCIENCES

4.3.2 Planet earth and the universe

4.3.3 The inner Planets

4.3.4 EDUCATOR SECTION

4.3.5 Memorandum

Assignment 5:

1. Mercury
2. There is no oxygen and no water on Mars. The atmosphere is also too thin to keep out harmful UV rays.
3. Venus has almost the same mass and size as the earth.
4. Venus (sulphuric acid)
5. The orbit of Mars is much closer to the Sun than Neptune's.
6. The Moon.
7. There is iron in the ground that gives it the red colour.

[3]This content is available online at <http://cnx.org/content/m20541/1.1/>.

8. Sufficient oxygen and water; climate is suitable for vegetation, atmosphere correct depth and density.

9. If emergency signals are sent they reach the earth only two hours later. Sometimes the reception is very bad.

Total: 10

Assignment 6:

- Use assessment matrix

Assignment 7:

1. Venus and the Moon.

2. 150 million km. This is the distance that the Earth is from the Sun and where we currently survive.

3. Mercury.

4. Venus and Mars lie on either side of the Earth, not too near or too far from the Sun.

5. Yes. The nearer the planet to the Sun, the higher the average speed.

6. Possible as a result of the gravity and energy of the Sun.

Four minutes.24 x 60 minutes = 1440 minutes (it takes the earth 24 hours to rotate on its own axis)1400 minutes divided by 360 degrees = 4 minutes.

Assignment 8.1:

Questions

1. Photographs show that there are dry river beds on Mars. All the water has frozen and is collected at the poles. We surmise that there were large seas and rivers. This water is now underground.

2. The average temperature is possibly higher.

3. Mars is further from the Sun and thus receives less energy from the Sun. Although the Sun is a huge source of energy it will one day shrink and weaken.

4. One would breathe with difficulty and take shallow breathes. One would die quickly as there is too much carbon dioxide in the air.

Assignment 8.2:

Questions

1. -60 degrees

2. Day 1 18:20

Day 2 10:45

3. Day 1 14:30

- 15 degrees

4. from 06:00

5. When there is a dust storm it absorbs heat from the Sun which causes the temperature to rise. There is also carbon dioxide in the Martian atmosphere and this can also raise the temperature.

- Open answer; any realistic explanation.

4.3.6

4.3.7

4.3.8 LEANER SECTION

4.3.9 Content

4.3.9.1 Activity: To discuss the planets of our solar system [LO 1.2, LO 1.3, LO 2.1, LO 2.2, LO 2.3]

- Mercury

This is the closet planet to the sun. Mercury has many craters on its surface caused by asteroids which have collided with the planet. Mercury has no atmosphere or any moons. The temperature at the equator is approximately 400 degrees Celsius and at the poles it is –150 degrees Celsius.

- Venus

Venus has an atmosphere of carbon dioxide that is much thicker than the earth's atmosphere. The surface is hidden beneath thick clouds of sulphuric acid. Temperatures at the surface reach approximately 480 degrees Celsius. Venus is about the same size as the earth and has about the same mass.

- Earth

As far as we know the earth is the only place in the universe where life occurs. Temperatures on the surface vary between 60 degrees and –90 degrees Celsius. Approximately two thirds of the surface is covered by liquid water.

- Mars

Mars is also called the Red Planet because the iron on its surface gives off a red glow. The atmosphere is about 100 times less dense than that of the earth. It consists of carbon dioxide with very small quantities of water vapour. Ice fields form at a temperature of –125 degrees Celsius in winter. Summer temperatures reach a maximum of 20 degrees Celsius.

Illustration of the position of the planets in the solar system

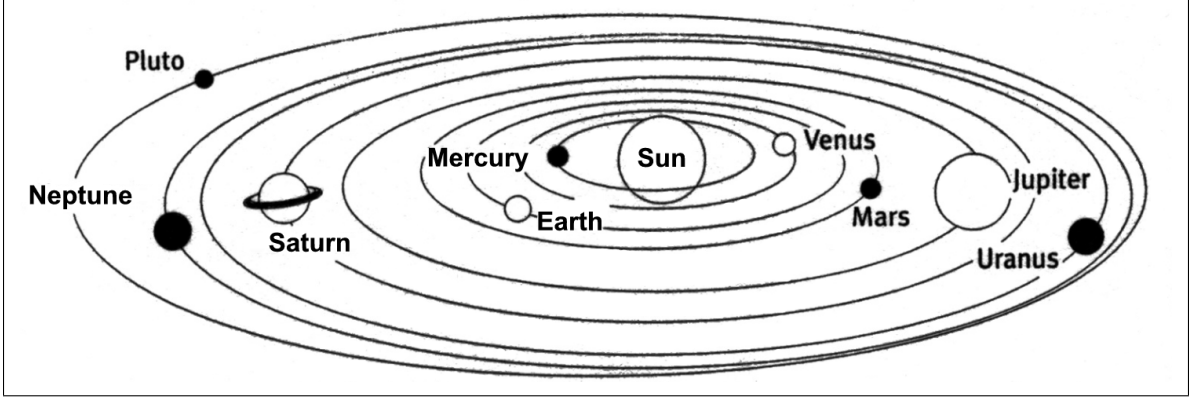


Table 4.4

THE OUTER PLANETS

- Jupiter

Jupiter contains 300 times as much matter as the earth and is the largest planet in the solar system. Jupiter is a giant ball of liquid gas and possibly has no solid surface. The only features that can be seen through a telescope are coloured stripes of clouds stretching around Jupiter. Jupiter has a large red spot known as the Red Spot. It is a tornado (a storm) which rages permanently and covers an area greater than the earth's surface.

- Saturn

Saturn is the second gas giant and is very much like Jupiter. It consists mainly of hydrogen and helium with a surface temperature of –170 degrees Celsius. Saturn's spectacular rings make it one of the brightest objects in our solar system. The rings move around the equator of Saturn in a very thin band. They consist of millions of pieces of ice, almost like snowballs. Saturn has seventeen moons of which Titan is probably the largest in our solar system. Two Voyager spacecraft have already been dispatched to explore the outer planets. Saturn is eight times further from us than the sun. It takes the radio signals from the spacecraft more than an hour to reach the earth.

- Uranus, Neptune and Pluto

These three planets are very far from the earth and are known as the ice giants. Surface temperatures vary between –197 degrees Celsius to –233 degrees Celsius.

Figure 4.3

4.3.9.1.1 TASK 4

- Use the initial letters of the names of the planets, (M, V, E, M, J, S, U, N, P) to make a rhyme or story to help you remember the order of the planets.

_____
_____
_____
_____
_____
_____
_____
_____
TASK 5
Answer the following questions:
1. Which planet becomes so hot that lead would melt on its surface?
_____
2. Give two reasons why life as we know it is impossible on Mars.
_____
_____
3. Why is Venus sometimes called Earth's twin?
_____
_____
4. On which planet is there a large amount of the material used in car batteries to be found?
_____
5. Why is the maximum temperature on Mars much higher than that on Neptune?
_____
_____
6. On which other body besides Earth in our solar system have people walked?

____

7. Why is Mars sometimes called the Red Planet?

____

____

8. Why is life as we know it possible on Earth?

____

____

9. Radio signals take more than an hour to reach the earth from Saturn. What dangers could this hold for spacecraft undertaking exploration?

____

____

(10)

TASK 6: TRANSLATE FROM TABLE TO GRAPH

Show two of the columns of information below by means of graphs. Use columnar, circular or linear graphs.

Planet	Distance from the sun in millions of kilometres	Radius in km	Number of moons	Average speed in km per second
Mercury	58	4 878	0	48
Venus	108	12 104	0	35
Earth	150	12 756	1	30
Mars	228	6 794	2	24
Jupiter	778	142 800	16	13
Saturn	1 427	120 000	17	10
Uranus	2 870	52 000	15	7
Neptune	4 497	48 000	2	5
Pluto	5 900	2 400	1	5

Table 4.5

Criteria for Assessing Graphs	1.	2.	3.	4.
1. Heading				
2. Description of both axes				
3. Scale correctly shown				
4. Co-ordinates correctly shown				
5. Completeness				
6. Neatness and care taken				

Table 4.6

Comment:

TASK 7

Use the information in the tables to make deductions and to answer the following questions:

1. Which two planets are the closest together?

_____
_____

2. What is the ideal distance from the sun for human survival?

_____
_____

3. Which planet has a radius about twice that of Pluto?

4. Which two planets besides Earth could possibly be a home for humans?

_____
_____
_____

5. Has the distance from the sun any influence on the average speed of a planet? Which rule could you make for this?

_____
_____
_____

6. Give a possible explanation for this.

_____
_____
_____
_____
_____
_____

7. If the earth moves at a speed of 30 km per second, how long does it take the earth to move from one line of longitude to the next. Remember, there are 360 lines of longitude.

_____
_____
_____

group assessment: making deductions		
1. We could make direct deductions.	Yes	No
2. We could give a sensible explanation for human survival.	Yes	No
3. We could formulate a rule about the distance of planets from the sun.	Yes	No
4. We could give a sensible explanation for the above.	Yes	No
5. We could calculate how long it takes the earth to move through one degree of longitude.	Yes	No
6. We could answer most of the questions independently.	Yes	No
7. Co-operation in the group was good.	Yes	No
8. Each individual made a contribution.	Yes	No

Table 4.7

Group judges success of the exercise: _____

TASK 8

8.1 Mars – a rare planet

Read the facts below and discuss the questions in your groups.

- Mars has a north and south pole that are white because of frozen snow and carbon dioxide.
- The length of the day on Mars is only 41 minutes longer than the length of a day on Earth.

- A year on Mars is however as long as 687 days on Earth. There are two seasons on Mars, summer and winter. During summer there are fierce dust storms, which make the sky appear pink and orange.
- The dust absorbs energy from the sun and this allows the temperature to rise to 20 degrees Celsius.
- The atmosphere on Mars is very thin and dangerous ultra-violet rays can thus reach the surface.
- Scientists believe that long ago there was water on Mars with large rivers and seas. These days there is almost no water left on the surface but they suspect that there is underground water.
- No photograph shows any sign of life on Mars. Life as we know it can only exist if there is oxygen.

QUESTIONS:

1. Why do scientists think that there was water on Mars long ago?

_____
_____
_____

2. If there was liquid water on Mars long ago, what can we deduce about the temperature on Mars at that time?

_____
_____
_____

3. Why is Mars so cold now?

_____
_____
_____

4. What would if feel like to breathe on Mars?

_____
_____
_____

8.2 Temperature on Mars

Robot vehicles measured the temperature on Mars over a two-day period.

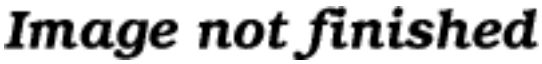


Figure 4.4

The horizontal axis shows us earth time. The 14 means 14:00 (2 pm) and 18 means 18:00 (6 pm).

- The vertical axis shows the temperature in degrees Celsius.

Now answer the following questions:

1. What was the temperature at 21:00 on Day 1?

_____
_____

2. At what time was the temperature –40 degrees Celsius?

_____
_____

3. At what time was the temperature at its highest? What was the temperature at that time?

_____
_____

4. At what time did the temperature begin to rise on Day 2?

_____

5. Give a possible reason for this rise in temperature.

8.3 Life on Mars?

Life on Mars is not possible as there is no oxygen and also no water. If astronauts erect a base on Mars, obtaining sufficient water will be a one of their greatest problems. They could take water with them but it would quickly be exhausted.

One could argue that plants might be able to recover water as the leaves release water vapour, which condenses and runs down to the root as liquid water.

Figure 4.5

Think about the following:

- Could plants be used to produce water in the base?
- Is this possible without oxygen?
- Can enough water for human consumption be produced like this?
- Is there enough energy to use the water for human consumption?

Each group now reports their findings briefly, motivating any statements that are made.

MAIN POINTS OF REPORT:

4.3.10 Assessment

Learning Outcome 1: The learner will be able to act confidently on curiosity about natural phenomena, and to investigate relationships and solve problems in scientific, technological and environmental contexts.

Assessment Standard 1.2: We know this when the learner conducts investigations and collects data: organises and uses equipment or source to gather and record information;

Assessment Standard 1.3: We know this when the learner evaluates data and communicates findings: generalises in terms of a relevant aspect and describes how the data supports the generalisation

Learning Outcome 2: The learner will know and be able to interpret and apply scientific, technological and environmental knowledge.

Assessment Standard 2.1: We know this when the learner categorises information: compares features of different categories of objects, organisms and events;

Assessment Standard 2.3: We know this when the learner interprets information: interprets information by identifying key ideas in text, finding patterns in recorded data, and making inferences from information in various forms (e.g. pictures, diagrams, text).

4.4 To analyse the structure of the earth and to measure movements in it (natural disasters)[4]

4.4.1 NATURAL SCIENCES

4.4.2 Planet earth and the universe

4.4.3 The Earth

4.4.4

4.4.5 EDUCATOR SECTION

4.4.6 Memorandum

Assignment 1:

- Assess using the assessment matrix.

Assignment 2:
Main Ideas

- Earthquake: evening of 29 September 1969.
- Registers 6.5 on the Richter Scale.
- Chaos in most places.
- Rumbling grew louder and louder and was followed by tremendous quake.
- The whole earth shuddered and people ran about panic stricken.
- Rescuers used the Post Office as a base because it was the only place which had electricity.
- Homes were badly damaged and people were badly injured.
- Emergency aid streamed to the disaster towns and the police and army co-operated.
- People were housed in tents and field hospitals were erected.
- The water shortage was alleviated and food was supplied.
- R13 million donated by the Disaster Committee

Assignment 3:

- (sketch)

Assignment 4:
1. The Richter Scale is the instrument (scale) which seismologists use to measure the strength of an earthquake.
2. Seismologists are scientists who study earthquakes.

[4]This content is available online at <http://cnx.org/content/m20545/1.1/>.

3. The place at which the shock waves first reach the surface of the earth is known as the epicentre.
4. If the pressure in the mantel under the crust builds up then magma is forced through weak places and cracks. These weak places then form volcanic pipes.
5. Active volcanoes are volcanoes which erupt from time to time.

4.4.7 LEANER SECTION

4.4.8 Content

4.4.9 Activity: To analyse the structure of the earth and to measure movements in it (natural disasters) [LO 2.1, LO 2.3]

STRUCTURE OF THE EARTH

- Scientists believe that Earth came into existence about 4 600 million years ago as a large cloud of gas and dust swirling around in space. While it was rotating it shrank to an extremely hot, liquid ball. The surface gradually cooled and a crust of solid rock formed which weathered to the mountains, soil and sand on which we live today.
- Earth is continually changing. The land masses (continents) are not only moving, but new crust is forming all the time. The movement of the crust is called continental drift and it is still occurring. America, for example, is moving gradually away from Europe. This movement has already led to telephone cables under the Atlantic breaking.

FOUR LAYERS OF THE EARTH

- The Crust

The crust is the outermost layer and has a thickness of from 5 km to 70 km. Under the oceans the crust can be as thin as 5 km and where there are mountains the crust can be as thick as 70 km. Beneath the crust there are three other layers. They are:

- The Mantle

The mantle is 2 900 km thick. It is solid but contains slowly flowing currents of semi-melted metals.

- The outer Core

The outer core consists of liquid metal and is responsible for the earth's magnetic field. It is 2 240 km thick.

- The inner Core

The inner core in the middle of the earth is probably solid and consists mainly of metals. The temperature is 3 700 degrees Celsius. Water boils at 100 degrees Celsius. The inner core has a diameter of 2 240 km.

The lava that flows from volcanoes comes from the mantle.

TASK 1: GROUP WORK

Use playing dough (four different colours) to make a model of Earth's structure. The thickness of each layer should be more or less proportional to the actual thickness of the earth's layer.

Use a ball of red clay for the centre of the earth:

When the model is complete, change it into a cut-away model:

- Cut the ball into two halves along the equator to make a northern and a southern hemisphere.
- Cut the northern hemisphere in half to make two quarter spheres.
- Place one of these back onto the southern hemisphere.

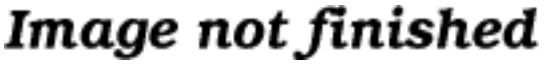


Figure 4.6

group assessment: model		
1. Good co-operation in group; all members make sensible contributions	Yes	No
2. Model: Layers in correct order	Yes	No
3. Model: Uses colour	Yes	No
8. Open work model: Correct steps followed and layers can be distinguished.	Yes	No

Table 4.8

Comment: _____

EARTHQUAKES

Scientists believe that in the past all the continents belonged to a single landmass that they have called Pangea. About 300 million years ago this landmass split into pieces that have drifted away from each other to the present position of the continents.

- The pieces into which the crust has divided are known as plates and each plate is about 40 km thick. They float because the rocks they consist of are lighter than the melted section of the mantle underneath. Sometimes they collide with each other and this causes deep trenches in the ocean floor and high mountains on land. The Himalayas, the highest mountain range on Earth, is still being pressed upwards by the collision between India and Asia. The Great Rift Valley, a tear that stretches across a large part of Africa, was formed when the surface sank along the line of two plates that were separating. Strong earthquakes can damage buildings, bridges and roads. Well-constructed buildings will suffer the least damage.
- Seismologists are scientists who study earthquakes. They measure the strength of an earthquake on the Richter scale. On this scale 1 equals a small earthquake that is felt as a light trembling on the surface. A large earthquake of 7 will cause huge damage to buildings, power supplies, roads etc. The place where the waves of the earthquake first reach the surface of the earth is called the epicentre. The effect of the earthquake is the greatest here. Sometimes the epicentre is under the sea. Then huge waves called tsunamis are caused.

TASK 2:

On 29 September 1969 an earthquake caused severe damage in the Boland towns of Ceres, Tulbagh and Wolseley. Read the news report below, printed in Die Burger of 9 September 1989, and summarise it. Make sure that you include all the main points.

THE NIGHT WHEN THE BOLAND MOUNTAINS RUMBLED

EARTHQUAKE: TWENTY YEARS LATER.

When light tremors rolled over the mountains of Tulbagh, Wolseley and Ceres on the morning of 29 September 1969, few people thought that their homes and farms would be badly damaged, or even destroyed. And today, twenty years after the disastrous spring evening when an earthquake of 6.5 on the Richter Scale shook the earth here, people are still talking about it."It was chaos," said Mr Dirkie Hougaard (49) of Tulbagh. I was working at the telephone exchange at the time and was alone when the earth began to rumble. But an earthquake was the last thing that I thought of. Not many people thought it was.Shortly

before ten o'clock he became worried when the rumbling became louder and more regular. Before anyone knew what was happening there was a gigantic quake. It was four minutes past ten."The whole earth shook. The lampshades were shaken from the roof, walls wobbled and in some places collapsed. Taps were shaken loose and water streamed everywhere. I realised that I had to run outside. Outside it looked misty as a result of the dust cloud that hung over the village. Everyone was in a panic."Mr Hougaard managed to start the emergency generator of the Post Office and help was summoned from the Police, Divisional Council and later the Army.

AMOUNT

Because the post office was the only place in the town that still had electricity it served as a base for rescue workers. As Mr Hougaard received telephonic information about inhabitants severely affected by the earthquake, rescuers were sent out."The lines were overloaded because everyone was phoning to hear what had happened and where they should go."Shortly after this Mr Hougaard went to have a look at his own house, which he had just bought. Although he can't remember the exact amount, the damage caused to his house cost more to repair than he paid for the house originally.His wife, who was expecting their second child, was cut on the head when a badminton trophy fell from the pelmet onto her head. For months after this she refused to sleep inside at night.Mr NC Krone, owner of Twee Jonge Gezellen and vice-chairman of the Boland Disaster Committee said that most inhabitants of Tulbagh were badly affected, yet the spirit of co-operation was a wonderful memory. "Emergency aid streamed into the disaster-struck towns and a comprehensive disaster relief programme was instituted on the night of the earthquake by the Defence Force with the assistance of the Police and local authorities."The next day 400 tents were erected in Tulbagh, 250 in Wolseley, and 100 in Ceres. The Army erected a field hospital in Wolseley. Two days later the water shortage was relieved and new pipes were laid to the mountains to replace pipes damaged by falling rocks.

DONATIONS

Nearly all of the R13 million controlled by the Disaster Committee was spent. Almost R1.3 million was raised from public donations.

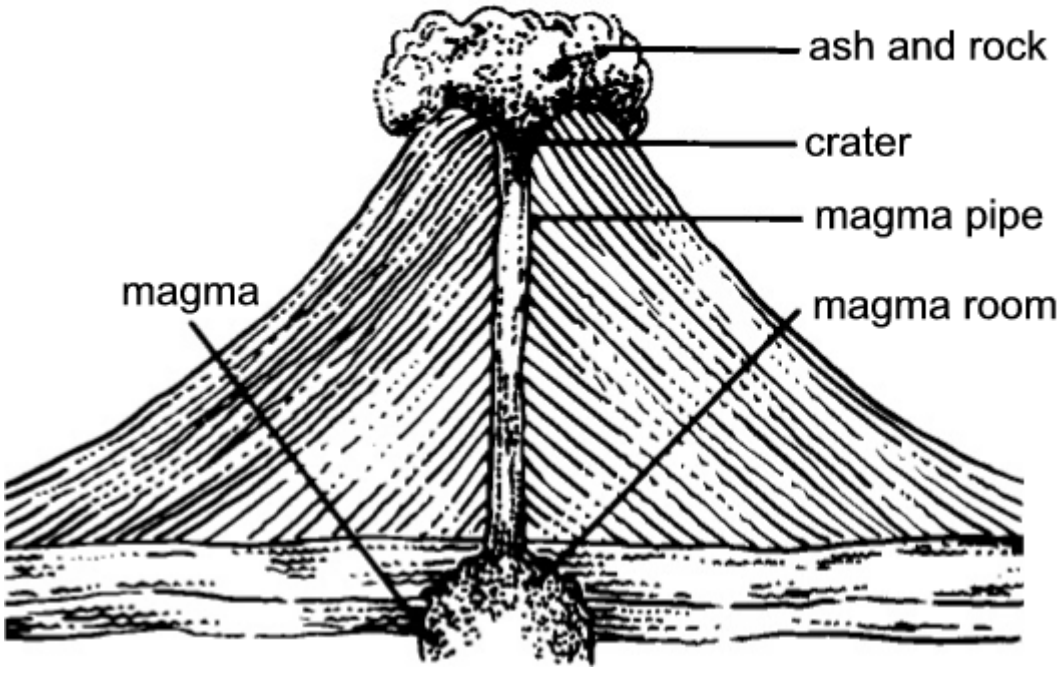
My summary:

group assessment: model		
1. Prescribed length was maintained.	Yes	No
2. Main ideas have been identified.	Yes	No
3. Main ideas have been correctly put in paragraphs.	Yes	No
8. Complete sentences, good language usage and correct punctuation.	Yes	No

Table 4.9

VOLCANOES

- If the pressure under the mantle builds up the magma is forced through weak places and cracks in the crust. These weak places form volcanic pipes. When the magma reaches the surface of the earth it forms solid rock. This rock blocks the volcanic pipe and the pressure from below builds up. Eventually the pressure is sufficient to cause a huge explosion. The solid rock (the plug) is blown away and the magma erupts from the pipe. A volcanic explosion like this can sometimes destroy a whole town.
- There are fewer than 500 active volcanoes on Earth. An active volcano is one that erupts from time to time. More than half of these volcanoes are in an area around the Pacific Ocean.



The inside of a volcano

Table 4.10

TASK 3:

Use the map of the world below and show the area where volcanoes mainly occur. Use an atlas to show where the following volcanoes are.

- Mount Etna
- Hawaii

- Mount Pinatubo

Figure 4.7

TASK 4:
Use the previous information on volcanoes and earthquakes and define the following terms:

	Term	Definitions
1.	Richter scale	_ _
2.	Seismologist	_ _
3.	Epicentre	_ _
4.	Volcanic pipe	_ _
5.	Active volcano	_ _
	Self assessment 5 X 2 = (10)	

Table 4.11

4.4.10 Assessment

Learning Outcome 2: The learner will know and be able to interpret and apply scientific, technological and environmental knowledge.

Assessment Standard 2.1: We know this when the learner categorises information: compares features of different categories of objects, organisms and events;

Assessment Standard 2.3: We know this when the learner interprets information: interprets information by identifying key ideas in text, finding patterns in recorded data, and making inferences from information in various forms (e.g. pictures, diagrams, text).

4.5 To study the properties of the moon and to identify their influences on the earth[5]

4.5.1 NATURAL SCIENCES

4.5.2 Planet earth and the universe

4.5.3 The Earth

4.5.4 EDUCATOR SECTION

4.5.5 Memorandum

Assignment 5:
4 (sketch)
Assignment 6:
True
True
False; the first moon landing was in 1969n when the Americans Nail Armstrong and Edwin Aldrin landed on the Moon in Apollo II.
True
False; During neap tide the tide is a bit lower than normal.
False; the moon looks bigger than other objects because it is the nearest celestial body to the earth.
True

4.5.6 LEANER SECTION

4.5.7 Content

4.5.7.1 Activity: To study the properties of the moon and to identify their influences on the earth [LO 1.3, LO 2.3]

INTRODUCTION

- Earth has one moon that orbits it. The moon has no light of its own but reflects sunlight. It takes the moon 29,5 days to orbit the earth. There is no life, air, wind or water on the moon. Comets, asteroids and meteors that have collided with the moon have caused huge craters on the surface. Temperatures on the moon vary from 200 degrees Celsius to –120 degrees Celsius.
- At different times of the month the moon appears to assume different shapes. This is because the human eye sees different parts of the moon that are illuminated by the sun as the moon orbits around the earth.
- As the moon orbits, it influences the sea level as the moon has its own gravity, which affects the sea. This change in water levels is called the tides.

PHASES OF THE MOON

- When the moon is exactly between the earth and the sun it cannot be seen. This is known as a New moon. Thereafter the moon resembles a sickle. This is known as a Crescent moon. Only a small portion of the moon is visible. As the moon travels around the earth, the visible portion grows larger until the First quarter is reached. The sunlit area continues to grow until Full moon. Then the sunlit portion grows smaller until it reaches the Last quarter and continues to shrink until the visible portion forms the Crescent moon again and so on until the next New moon.

[5] This content is available online at <http://cnx.org/content/m20553/1.1/>.

TIDES

- Because the moon is much closer to the earth than the sun it has a far greater gravitational effect on the earth. At full moon and new moon both the moon and the sun pull on the earth in the same direction. This means that the tides are higher than normal. This is known as spring tide.
- When the moon is in the first and last quarter the sun and the moon pull at right angles to each other. This causes tides that are lower than usual. This is known as neap tide. The earth rotates around its axis every 24 hours and so there are two high tides and two low tides every day.

TASK 5

On the sketch below supply the correct labels for the phases of the moon.

TASK 6

STATEMENT	T	F	CORRECTION
The moon is a satellite of the earth.			_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _
The earth is a satellite of the sun.			_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _
No astronauts have landed on the moon.			_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _
A lunar eclipse doesn't occur with each full moon because most of the time the moon does not move through the earth's shadow.			_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _
During neap tide the level of the sea is slightly higher than normal.			_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _
The moon looks bigger than other celestial objects, because it is immensely large.			_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _
The first and last quarters of the moon are also known as *Half moon. (10)*			_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

Table 4.12

4.5.8 Assessment

Learning Outcome 1: The learner will be able to act confidently on curiosity about natural phenomena, and to investigate relationships and solve problems in scientific, technological and environmental contexts.

Assessment Standard 1.3: We know this when the learner evaluates data and communicates findings: generalises in terms of a relevant aspect and describes how the data supports the generalisation

Learning Outcome 2: The learner will know and be able to interpret and apply scientific, technological and environmental knowledge.

Assessment Standard 2.3: We know this when the learner interprets information: interprets information by identifying key ideas in text, finding patterns in recorded data, and making inferences from information in various forms (e.g. pictures, diagrams, text).

4.6 To represent the different layers in the earth's atmosphere visually and to investigate weather patterns and seasons[6]

4.6.1 NATURAL SCIENCES

4.6.2 Planet earth and the universe

4.6.3 The Earth

4.6.4 EDUCATOR SECTION

4.6.5 Memorandum

4.6.6

4.6.7 LEANER SECTION

4.6.8 Content

4.6.9 Activity: To represent the different layers in the earth's atmosphere visually and to investigate weather patterns and seasons [LO 2.3, LO 3.1]

THE ATMOSPHERE

A layer of air called atmosphere envelops the earth. This layer usually contains two gases, namely oxygen (78%) and nitrogen (20%). The atmosphere consists of a number of layers, of which each has its own characteristics.

LAYERS IN THE ATMOSPHERE

[6] This content is available online at <http://cnx.org/content/m20552/1.1/>.

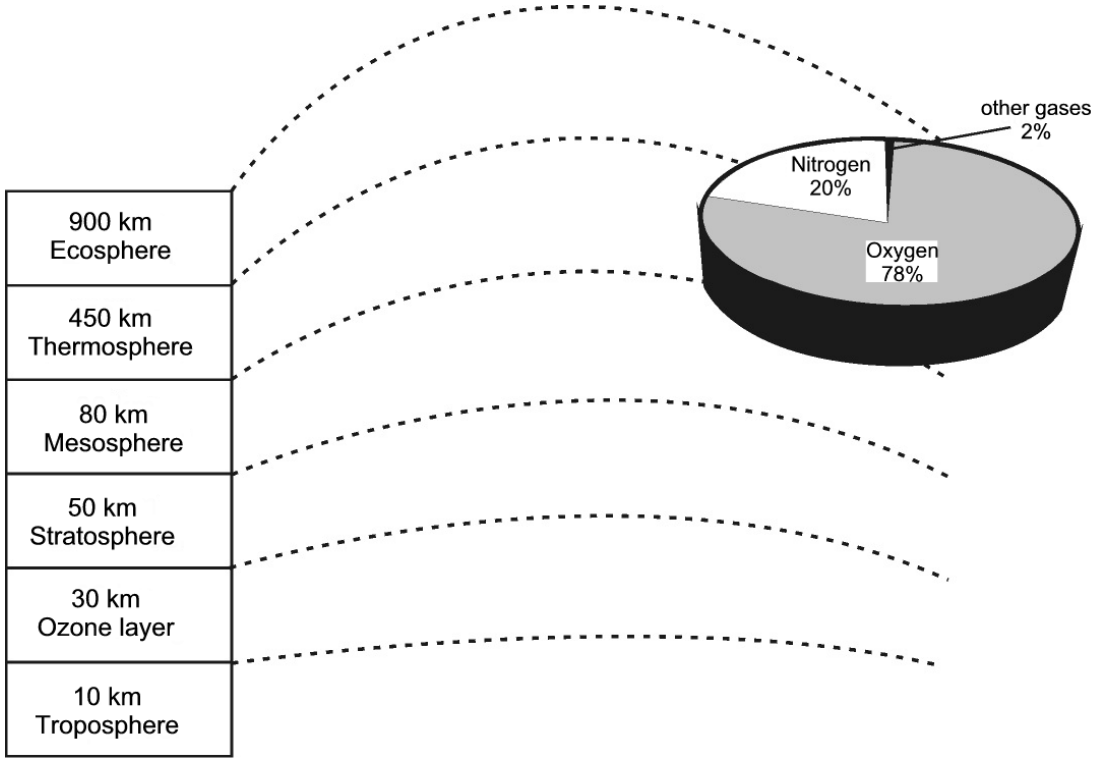


Figure 4.8

- Troposphere

This is the layer closest to Earth. Here we find all the weather patterns and clouds, and this is also where aeroplanes and birds fly.

- Ozone layer

The harmful ultra-violet rays of the sun are absorbed in this layer.

- Stratosphere

It is here that modern jets fly. Oxygen supply is insufficient for man to breathe.

- Mesosphere

Most small meteors burn out in this layer.

- Thermosphere

Most of the sun's heat is absorbed here; temperatures rise to 1 000 degrees Celsius.

- Ecosphere

There is almost no air in this layer. Only the lightest of gases are found here, as well as some weather satellites.

The above-mentioned layers do not have fixed limits and we can therefore say that they intermingle. The density decreases the higher the layer is until almost no air is present. Compared to the cross-section of the earth, the atmosphere is not really a very thick layer.

TASK 8:

Group work

- Using the information given, make a diagrammatical representation of Earth, showing all its layers.
- Use different colours to distinguish between the layers.
- Labels must be in print.
- The thickness of layers must be displayed.

Educator Assessment: Diagrammatical Rrepresentation	1.	2.	3.	4.
1. Aim: The message is carried over clearly				
2. Detail: Detail is accurate and clear				
3. Sketches and illustrations: Functional and purposeful				
4. Creativity: Representation is creative and original				
5. Presentation: neat and orderly				
DOMINANT CODE: .....MARK: ...../ 20 .....%Educator:.....				

Table 4.13

Commentary:

_____
_____
_____
_____

Learner: _____

4.6.10 Assessment

Learning Outcome 2: The learner will know and be able to interpret and apply scientific, technological and environmental knowledge.

Assessment Standard 2.3: We know this when the learner interprets information: interprets information by identifying key ideas in text, finding patterns in recorded data, and making inferences from information in various forms (e.g. pictures, diagrams, text).

Learning Outcome 3: The learner will be able to demonstrate an understanding of the interrelationships between science and technology, society and the environment.

Assessment Standard 3.1: We know this when the learner understands science as a human endeavour: compares differing interpretations of events.

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